



Treatment Preferences and Factors Influencing the Management of Primary Angle-Closure Suspect in China: A National Survey Study

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ABSTRACT

Introduction: This study explored the current views of ophthalmologists in China on the preferred strategy and the primary influencing factors in managing primary angle-closure suspect (PACS).

Methods: An online survey was distributed via WeChat to ophthalmologists working in hospitals at all levels throughout China to investigate the optimal management strategy and factors influencing the strategy for treating PACS from February to March 2023. Management strategies examined included regular observation (RO), laser peripheral iridectomy (LPI), and phacoemulsification with intraocular lens implantation (PEI). The study explored the factors that influenced clinical decision-making

processes and collected demographic information from the respondents for analysis.

Results: A total of 1009 ophthalmologists responded; 442 responders considered RO as a reasonable option for patients with PACS, while the majority opted for more positive treatments, with 460 choosing LPI and 107 selecting PEI. Further grouping analysis revealed significant differences between tertiary and lower-level hospitals ($P < 0.01$) and between public and private hospitals ($P < 0.05$). Significant differences were found among resident, attending, and senior doctors and between northern and southern hospitals. The top three considerations for ophthalmologists who selected RO were ultrasound biomicroscopy (UBM) without pupillary block, absence of a family history of glaucoma, and good compliance with regular follow-up. For LPI, the factors were UBM indicating pupillary block, glaucoma symptoms, and poor compliance with regular follow-up. For PEI the factors were age, family history of glaucoma, and poor compliance with regular follow-up.

Conclusion: The majority of ophthalmologists prefer aggressive treatments such as LPI or PEI over RO when dealing with patients with PACS. Disparity existed among ophthalmologists based on their level of experience, hospital ownership and level, and geographical location. The survey underscores the complexity and multifactorial nature of PACS management and highlights the need for further research and

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standardization of treatment protocols to ensure optimal patient outcomes.

Keywords: Primary angle-closure suspect; Management; Regular observation; Laser peripheral iridectomy; Phacoemulsification with intraocular lens implantation

Key Summary Points

Why carry out this study?

The current management strategies for primary angle-closure suspect (PACS) are diverse and chaotic. Multiple large-scale clinical trials have provided different recommendations for PACS treatment.

This study aimed to explore the current views of ophthalmologists in China on the preferred strategy and the primary influencing factors in managing PACS.

What was learned from the study?

The majority of ophthalmologists in China preferred aggressive treatments such as laser peripheral iridectomy or phacoemulsification with intraocular lens implantation over regular observation when dealing with patients with PACS.

Significant differences in treatment options existed among ophthalmologists based on their level of experience, hospital ownership and level, and geographical location. The presence of glaucoma symptoms, a family history of glaucoma, and axial length of the eye were identified as the top three factors influencing treatment decisions.

The complexity and multifactorial nature of PACS management highlights the need for further research and standardization of treatment protocols to ensure optimal patient outcomes.

INTRODUCTION

Primary angle-closure glaucoma (PACG) is a leading cause of irreversible blindness worldwide. It is estimated that at least 10 million people were affected by PACG in China by 2020, which accounts for approximately three-quarters of the total worldwide, and it has become a serious challenge for public health in China [1, 2]. The management of glaucoma has become an inescapable facet of ophthalmologists' professional experience and each ophthalmologist might have distinct perspectives on the diagnosis and therapy of glaucoma. Based on the scheme for the diagnosis of glaucoma developed by the International Society of Geographic and Epidemiologic Ophthalmology (ISGEO) in 2002 [3], the standard definition of primary angle-closure diseases (PACD) includes three categories: primary angle-closure suspect (PACS), primary angle-closure (PAC), and PACG. If patients are detected or treated in the PACS stage, the development of PACG can be suspended to some extent.

Since laser peripheral iridotomy (LPI) became available in the mid-1970s, it has been recommended as the initial treatment in subjects with PACD [4, 5]. However, its role in the treatment of PACS is still controversial. First, only a small minority of PACS progresses to PAC or PACG. Second, studies of anterior chamber depth following LPI have shown only a temporary widening effect on the anterior chamber angle depth (ACD) [6]. Third, LPI has been associated with a significant risk of developing cortical cataracts over a 6-year period [7]. The recent landmark randomized clinical trial (RCT) in China [Zhongshan Angle Closure Prevention (ZAP) trial] found that the incidence of angle-closure disease was very low among individuals classified as PACS and widespread prophylactic LPI for PACS was not recommended [8]. Another clinical-based prospective RCT, the Singapore Asymptomatic Narrow Angles Laser Iridotomy Study (ANA-LIS), reported the rare incidence of vision-threatening intraocular pressure elevation or the development of PACG or acute angle-closure (AAC) in patients with PACS, and there was no significant difference

between the LPI-treated eyes and control fellow eyes [9]. Both trials provided evidence and recommended that observation without LPI is a reasonable option for patients with PACS, which was conducive to changing the current practice patterns and alleviating the significant public health burden of patients with PACS.

Besides, a multicenter RCT to assess the efficacy of early lens extraction for the treatment of PACG (EAGLE) showed that clear-lens extraction was more effective in lowering intraocular pressure and cost-effective than LPI within 5 years and should be considered an option for first-line treatment [10]. Nevertheless, compared to those with regular anterior chamber depth, patients with PACS undergoing cataract surgery confront specific difficulties such as narrow operating space, high risk of complications, and inaccurate calculation of the power of the intraocular lens (IOLs). Thus, the popularization of lens extraction for PACS is also worth questioning.

In the context of the emergence of new insights from various large-scale clinical trials and the variability in PACS management, achieving consensus on the treatment of PACS appears to be a challenge. The objective of this study is to examine the current opinions of ophthalmologists with respect to the preferred management strategy of PACS and the related considerations in China. The findings of this study should shed light on the real-world management of PACS in a country with the largest number of patients with PACS.

METHODS

A nationwide questionnaire-based online survey was conducted among practicing ophthalmologists in China. The study was performed in accordance with the Helsinki Declaration of 1964 and its later amendments and approved by the Ethics Committee of Peking University People's Hospital (2018PHC011). All participants were aware of the collection of their data for this study and informed consent was obtained from each participant. This survey was voluntary, ensuring that ophthalmologists with

an interest in glaucoma were more prone to be engaged in completing the questionnaire.

The survey questionnaire was distributed through the WeChat platform to ophthalmologists in hospitals across provinces and cities in China from February 2023 to March 2023, as well as to ophthalmologists within various levels of ophthalmology associations. The questionnaire was disseminated either through ophthalmologists WeChat groups or sent directly to individual ophthalmologists. To ensure participation from interested physicians, the questionnaire was sent once with a reminder sent during the survey collection period. The inclusion criteria were practicing ophthalmologists in hospitals at all levels and all cities across China, including tertiary and lower-level hospitals, provincial, municipal, and county hospitals, public and private hospitals, specialized and general hospitals. All included ophthalmologists have obtained a professional ophthalmology license and completed specialized training for ophthalmic residents. Attending doctor refers to a doctor who has worked as a resident for 2 years and has passed the intermediate professional title examination. Senior doctor refers to a doctor who has worked as attending doctor for at least 5 years and has passed the senior professional title examination. The questionnaire (Supplementary Material) comprised a total of 14 items, with a primary focus on the following aspects: (1) Treatment preferences for patients with PACS presenting with shallow anterior chamber depth and narrow anterior chamber angle, without other ocular comorbidities (such as cataracts requiring treatment, retinal diseases, or glaucomatous optic nerve damage). Response options included LPI, regular observation (RO), and phacoemulsification with intraocular lens implantation (PEI). (2) Key factors taken into consideration when choosing a management strategy for a patient with PACS without other ocular comorbidities. Response options included patient age, family history of glaucoma, axial length, presence of glaucoma symptoms, compliance with regular follow-up, patient preference, ultrasound biomicroscopy (UBM) with or without pupillary block and none of the above. (3) Demographic information of the

respondents, such as their gender, professional titles, whether they were glaucoma specialists or not, hospital level, hospital ownership (public or private), and the administrative and geographical regions where they worked.

Sample Size Calculation

The determination of the sample size was based on preliminary findings drawn from a limited-scale questionnaire survey, utilizing binary logistic regression analysis. PASS (Power Analysis and Sample Size) 2019 software was employed for sample size calculation. Within the initial cohort comprising 355 participants, the proportion of northern hospitals opting for LPI and PEI in the management of PACS was 0.52, whereas their southern counterparts exhibited a ratio of 0.60 for this treatment preference. The coefficient of determination (R^2) pertaining to a spectrum of potential influencing factors was established at 0.60. With a predefined significance level (α) of 0.05, a power ($1 - \beta$) of 0.90, and the utilization of logistic regression analysis in the PASS software, the estimated requisite number of fully completed questionnaires amounted to 993. Considering an invalid questionnaire rate of 10%, we calculated that a minimum of 1103 responses should be collected.

Statistical Analysis

Statistical analysis was performed by using SPSS software (version 24.0; SPSS Inc., Chicago, IL, USA). The questionnaire responses were analyzed as categorical variables and were compared using the chi-square test. Subsequently, logistic regression models were employed to investigate the influence of demographic variables on the selection of management strategy. $P < 0.05$ was considered statistically significant.

RESULTS

In total, the questionnaire was sent to 1538 ophthalmologists through WeChat groups and individuals and we received 1269 responses to

the survey. After verification for logical consistency and completeness, 1009 questionnaires were eligible for analysis, a valid response rate of 79.51%.

Demographic Characteristics

Of the 1009 ophthalmologists who participated in the survey, 600 were female (59.46%) and 409 were male (40.54%). Among the participants, 646 worked in tertiary hospitals (64.02%), whereas the remaining worked in lower-level hospitals (35.98%). Of the total respondents, 775 worked in public hospitals (76.81%), while 234 worked in private hospitals (23.19%). Further stratification by hospital type revealed that 295 ophthalmologists worked in specialized hospitals (29.24%), and 714 worked in general hospitals (70.76%). Regarding the degree of economic development based on the administrative region, 344 participants (34.09%) worked in provincial hospitals, 414 (41.03%) in municipal hospitals, and 251 (24.88%) in county hospitals. The location of the hospital was analyzed on the basis of the traditional concept of the Qinling-Huaihe geographic demarcation line, which serves as a traditional dividing line between the northern and southern regions of China, and the socioeconomic divide that delineates the country into eastern and western regions. According to this analysis, 556 (55.10%) participants were from northern hospitals, whereas 453 (44.90%) were from southern hospitals. Moreover, 667 (66.11%) participants were from eastern hospitals, and 342 (33.89%) were from western hospitals. Of all the ophthalmologists who participated, 288 (28.54%) considered themselves glaucoma specialists, while the others were nonglaucoma specialists. Meanwhile, 577 (57.19%) responders were senior doctors, 319 (31.62%) responders were attending doctors, and 113 (11.19%) were resident doctors (Table 1).

Table 1 Distribution of professional features and titles of responders based on employing institution

Institution	n (%)	Grouping by specialty		Grouping by professional titles		
		Glaucoma specialty (n)	Non-glaucoma specialty (n)	Senior doctors (n)	Attending doctors (n)	Resident doctors (n)
Tertiary hospitals	646 (64.02%)	211	435	397	183	66
Lower-level hospitals	363 (35.98%)	77	286	180	136	47
Public hospitals	775 (76.81%)	208	567	457	238	80
Private hospitals	234 (23.19%)	80	154	120	81	33
Specialized hospitals	295 (29.24%)	115	180	155	97	43
General hospitals	714 (70.76%)	173	541	422	222	70
Provincial hospitals	344 (34.09%)	128	216	216	91	37
Municipal hospitals	414 (41.03%)	120	294	228	141	45
County hospitals	251 (24.88%)	40	211	133	87	31
Northern hospitals	556 (55.10%)	158	398	323	171	62
Southern hospitals	453 (44.90%)	130	323	254	148	51
Eastern hospitals	667 (66.11%)	183	484	382	214	71
Western hospitals	342 (33.89%)	105	238	195	105	42

Treatment Preferences and Influencing Factors

Overall, the most frequently selected treatment for patients with PACS was LPI (45.59%), followed by RO (43.81%) and PEI (10.60%). The considerations cited by the majority of respondents when making this treatment selection were the presence of glaucoma symptoms

(93.46%), family history of glaucoma (92.37%), and the patient’s axial length (86.22%). Although not among the top three considerations, patients’ age, treatment preference, and UBM findings suggestive of pupillary block were still selected by over 80% of respondents.

For ophthalmologists who chose LPI as the preferred treatment for PACS, the top three factors that were considered in the diagnostic

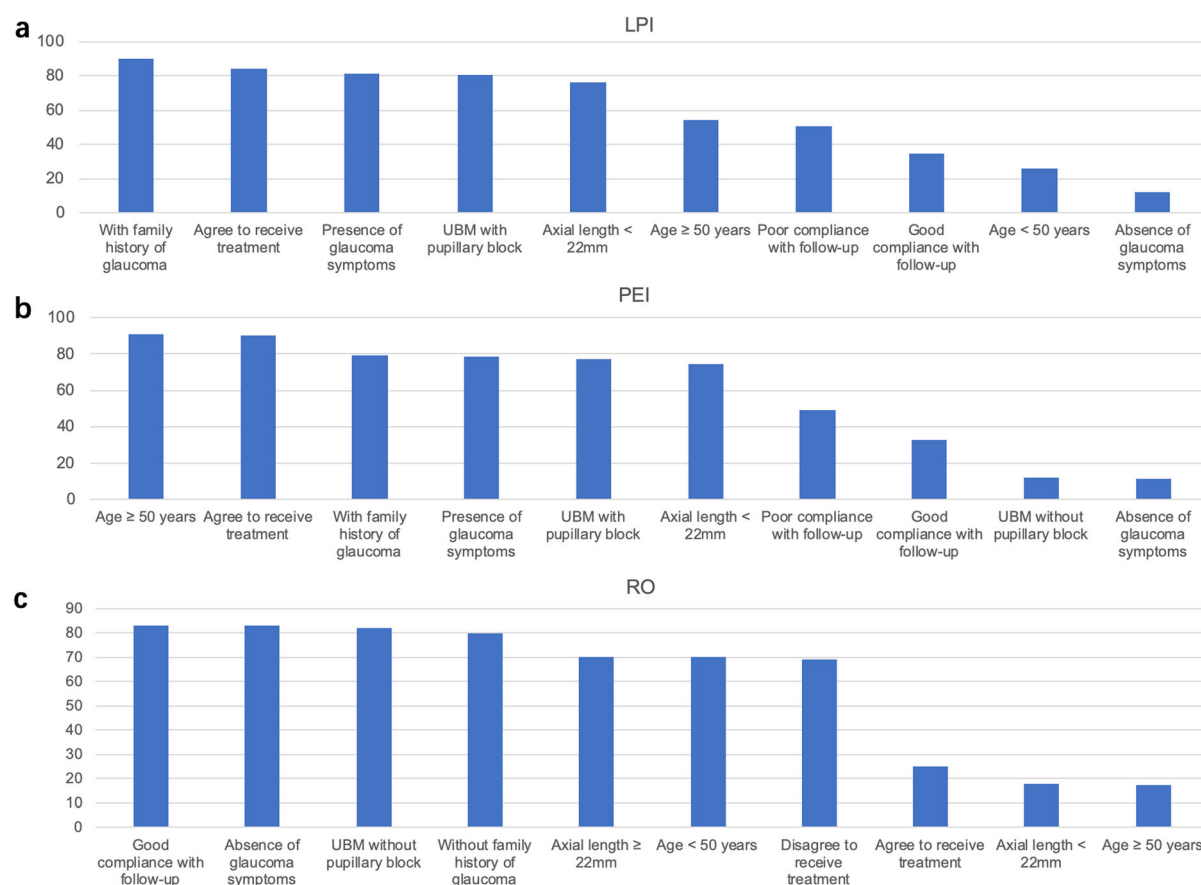


Fig. 1 The top 10 most considered factors for each selected treatment. Percentages of the considered factors for **a** LPI, **b** PEI, and **c** RO. *LPI* laser peripheral

iridectomy, *PEI* phacoemulsification with intraocular lens implantation, *RO* regular observation, *UBM* ultrasound biomicroscopy

and therapeutic process were the patient's family history of glaucoma, willingness of the patient to receive treatment, and presence of glaucoma symptoms (Fig. 1a). When all the factors were weighted and ranked, among the doctors who chose LPI, the factor most often selected as a key factor was UBM indicating the presence of pupil blockage (48.64%). The second most frequently selected factor was the presence of glaucoma symptoms (40.7%), and patient compliance with follow-up visits (61.18%) was third (Fig. 2a).

For ophthalmologists who preferred PEI as the initial treatment for PACS, the therapeutic process prioritized the following three key factors: patient age above 50 years, willingness of the patient to receive treatment, and a family history of glaucoma (Fig. 1b). Upon weighting

and ranking all relevant factors, ophthalmologists who opted for PEI consider patient age to be the most crucial factor (47.79%), followed by a family history of glaucoma (40.57%) and patient compliance with follow-up visits (57.53%), which were the second and third most commonly selected factors (Fig. 2b).

However, ophthalmologists who considered RO as the first choice of treatment were more influenced by the following factors: good compliance with regular follow-up, the absence of glaucoma symptoms, and UBM showing no pupillary block (Fig. 1c). Further ranking all relevant factors according to their importance, the most frequently selected was UBM indicating the absence of pupil blockage (45.76%), followed by axial length (38.14%) and good compliance with regular follow-up (59.62%).

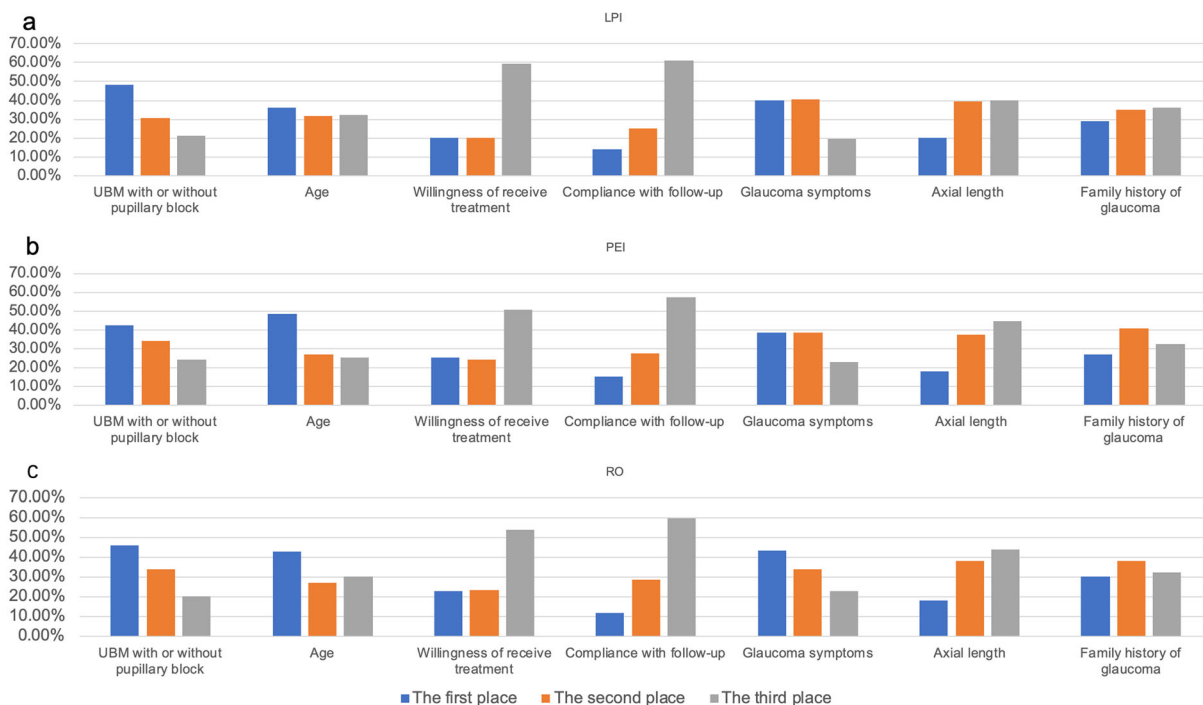


Fig. 2 Results of importance ranking analysis of the considered factors the respondents chose for each selected treatment. Importance ranking analysis of the considered factors for **a** LPI, **b** PEI, and **c** RO. *LPI* laser peripheral

iridectomy, *PEI* phacoemulsification with intraocular lens implantation, *RO* regular observation, *UBM* ultrasound biomicroscopy

These results indicated that good compliance is a fundamental requirement for doctors who choose RO, but they placed a greater emphasis on the absence of pupillary blockage on UBM (Fig. 2c).

Variations in Treatment Options Across Different Subgroups

We further categorized respondents on the basis of different demographic characteristics and analyzed the variations in clinical practice attitudes toward PACS management among different subgroups (Table 2). Significant differences were observed in treatment choices between ophthalmologists working in tertiary hospitals and those in lower-level hospitals (42.11%, 49.07%, and 8.82% versus 46.84%, 39.39%, and 13.77% for RO, LPI, and PEI, respectively; $\chi^2 = 11.331, P < 0.01$). There were also significant differences between public and private hospitals (44.26%, 46.45%, and 9.29% versus

42.30%, 42.74%, and 14.96% for RO, LPI and PEI, respectively; $\chi^2 = 6.144, P < 0.05$). Similarly, significant differences were found among resident, attending, and senior doctors ($\chi^2 = 11.899, P < 0.05$). In contrast, there were no significant differences in treatment selection based on gender, hospital type (specialist vs. general), or glaucoma expertise (specialist vs. nonspecialist).

Besides, 49.23% of ophthalmologists in southern hospitals recommended LPI, and 11.70% recommended PEI, compared with 42.55% and 9.69% in northern hospitals, respectively, while only 39.07% would advise RO for the management of PACS. Surprisingly, there was no significant difference in the preferred treatment choices for PACS between hospitals in the East and West regions, despite the traditionally perceived greater economic disparity between them.

We also conducted a multiple logistic regression analysis to clarify the specific impact

Table 2 Differences in preferred management strategies under different categories

	Male	Female	Tertiary hospitals	Lower-level hospitals	Public hospitals	Private hospitals	Specialized hospitals	General hospitals	Glaucoma specialists	Non-glaucoma specialists
LPI	190 (40.59%)	270 (45.00%)	317 (49.07%)	143 (39.39%)	360 (46.45%)	100 (42.74%)	327 (45.61%)	133 (45.55%)	128 (44.44%)	332 (46.05%)
PEI	53 (12.96%)	54 (9.00%)	57 (8.82%)	50 (13.77%)	72 (9.29%)	35 (14.96%)	76 (10.60%)	31 (10.62%)	38 (13.19%)	69 (9.57%)
RO	166 (46.45%)	276 (46.00%)	272 (42.11%)	170 (46.84%)	343 (44.26%)	99 (42.30%)	314 (43.79%)	128 (43.83%)	122 (42.37%)	320 (44.38%)
χ^2	5.333		11.331		6.144		0.000		2.857	
<i>P</i>	0.069		0.003*		0.046*		1.000		0.240	

	Senior doctors	Attending doctors	Resident doctors	Provincial hospitals	Municipal hospitals	County hospitals	Northern hospitals	Southern hospitals	Eastern hospitals	Western hospitals
LPI	257 (44.54%)	143 (44.83%)	60 (53.10%)	159 (46.22%)	196 (47.34%)	105 (41.83%)	236 (42.55%)	223 (49.23)	298 (44.76%)	161 (47.08%)
PEI	70 (12.13%)	22 (6.90%)	15 (13.27%)	27 (7.85%)	45 (10.87%)	35 (13.94%)	54 (9.69%)	53 (11.70)	71 (10.63%)	36 (10.53%)
RO	250 (43.33%)	154 (48.27%)	38 (33.63%)	178 (45.93%)	173 (41.79%)	111 (44.23%)	266 (47.76%)	177 (39.07)	298 (44.61%)	145 (42.39%)
χ^2	11.899			6.966			7.688		0.521	
<i>P</i>	0.018*			0.138			0.021*		0.771	

Data are presented as *n* (%)*LPI* laser peripheral iridectomy, *PEI* phacoemulsification with intraocular lens implantation, *RO* regular observation**P* < 0.05

Table 3 Association between different demographic characteristics and preferred treatment options (PEI/LPI)

PEI/LPI	Unadjusted		Adjusted for all relevant factors	
	<i>P</i>	OR (95% CI)	<i>P</i>	OR (95%CI)
Gender	0.122	1.395 (0.915–2.127)	0.862	1.039 (0.676–1.597)
Professional titles	0.039*	1.300 (1.014–1.666)	0.042*	1.311 (1.010–1.703)
Glaucoma specialists or not	0.117	1.428 (0.915–2.230)	0.180	1.387 (0.860–2.237)
Hospital levels	0.011*	1.564 (1.106–2.211)	0.437	1.202 (0.756–1.913)
Ownership of hospitals	0.017*	1.750 (1.104–2.774)	0.084	1.651 (0.935–2.912)
Hospital types	0.974	1.008 (0.634–1.602)	0.393	1.273 (0.732–2.212)
City levels of the hospital location	0.019*	0.719 (0.545–0.948)	0.031*	0.697 (0.502–0.968)
Northern or southern hospitals	0.844	1.043 (0.685–1.589)	0.862	1.039 (0.676–1.597)
Eastern or western hospitals	0.791	0.942 (0.604–1.469)	0.714	0.919 (0.585–1.444)

PEI phacoemulsification with intraocular lens implantation, LPI laser peripheral iridectomy, OR odds ratio, CI confidence interval

* $P < 0.05$

of different factors on the selection of the three treatment strategies (Tables 3 and 4). In the unadjusted regression models, hospital level, ownership of the hospital, professional title, and city level all exerted a statistically significant influence on the treatment preference between PEI and LPI. However, when a regression model that adjusted for all relevant factors was applied, only professional title and city level retained their significant impact on the choice between PEI and LPI. Regarding the selection between RO and LPI, the table demonstrated that both hospital level and geographical location (southern or northern) had a statistically significant effect on treatment choice, whether in fully adjusted models or not.

DISCUSSION

This study revealed that the majority of ophthalmologists preferred more aggressive treatments, such as LPI or PEI, over RO for patients with PACS. The presence of glaucoma symptoms, family history of glaucoma, and axial length of the eye were identified as the top three factors influencing treatment decisions.

Subsequent analysis revealed a noteworthy degree of heterogeneity in the treatment decisions by different groups of ophthalmologists. This disparity was particularly pronounced among doctors who differed in their level of experience, hospital ownership and level, and geographical location.

Although LPI is recommended as the initial treatment for patients with PAC and PACG in preferred practice guidelines [11], consensus on the management of PACS has been difficult to achieve. One of the reasons for divergent views is the significant variability in the prevalence of angle closure among different ethnicities worldwide. The prevalence ranges from negligible in European and Western populations to 2–3% in Inuit, Asian, and Indian populations, not even considering patients with PACS [12–14]. Therefore, as a result of the different main groups of patients with glaucoma and the corresponding clinical experiences, it is challenging to develop a globally unified treatment approach for PACS. In addition, management of PACS should be based on the risk of progression of PACS to angle closure and glaucoma. Wilensky [15] and Alsbirk [16] reported rates of PACS developing into acute angle-closure

Table 4 Association between different demographic characteristics and preferred treatment options (RO/LPI)

RO/LPI	Unadjusted		Adjusted for all relevant factors	
	<i>P</i>	OR (95% CI)	<i>P</i>	OR (95% CI)
Gender	0.239	0.852 (0.652–1.113)	0.226	0.841 (0.636–1.113)
Professional titles	0.583	0.961 (0.833–1.108)	0.733	0.974 (0.838–1.133)
Glaucoma specialists or not	0.984	0.997 (0.745–1.334)	0.619	1.082 (0.793–1.476)
Hospital levels	0.014*	1.334 (1.061–1.677)	0.006*	1.511 (1.123–2.033)
Ownership of hospitals	0.825	1.036 (0.756–1.419)	0.214	0.785 (0.537–1.150)
Hospital types	0.943	0.990 (0.743–1.318)	0.180	1.259 (0.899–1.764)
City levels of the hospital location	0.823	0.981 (0.826–1.164)	0.524	1.067 (0.874–1.302)
Northern or southern hospitals	0.010*	0.707 (0.543–0.921)	0.026*	0.737 (0.564–0.963)
Eastern or western hospitals	0.472	0.904 (0.686–1.191)	0.702	0.947 (0.716–1.252)

RO regular observation, LPI laser peripheral iridectomy, OR odds ratio, CI confidence interval

* $P < 0.05$

glaucoma ranging from 6% to 10%, and rates of developing PAC or PACG of 17–35%. Thomas et al. [17] found the rate of progression from PACS to PAC to be 22% over 5 years, with only 0.9% of controls progressing to PAC over the same period of time; no individuals developed PACG. Another study [18] found that 9.38% of the 5060 patients progressed to either PAC or PACG within the 6-year follow-up period. Given the significant differences among research results, the causes of which may be related to the varying standards for PACS inclusion and outcome evaluation across studies, the diverse research outcomes have blurred doctors' understanding of the risk associated with PACS development, resulting in inconsistent perceptions and ultimately leading to different treatment practices. Besides, the heterogeneous levels of professional competence among ophthalmologists, as well as the uneven distribution of advanced medical equipment across different institutions, can impose certain constraints on the diagnostic and therapeutic strategies employed. Over a prolonged period of clinical practice, such constraints may foster the development of entrenched diagnostic and therapeutic habits, making the clinician resist adaptation to the latest research findings.

It is reassuring to note that although there is a greater proportion of ophthalmologists electing to administer aggressive interventions, the differences in ratio between these strategies are no longer as great as those reported in previous studies. In the current study, 45.59% of the responders chose LPI, 10.60% chose PEI, and 43.81% chose RO. A national survey conducted in Singapore found that 85% of ophthalmologists advocated routine LPI treatment for patients with PACS [19], while Sheth et al. [20] reported that 74.7% (408/548 respondents) of ophthalmologists would perform LPI on patients with PACS. This shift in treatment emphasis may be attributed in part to the results of recent large RCTs [8, 9], which have altered our perception of PACS, as well as advancements in glaucoma-related diagnostic equipment, which allow doctors to monitor changes in patients' anatomical characteristics and detect and treat impending hazards promptly. Meanwhile, routine performance of LPI or PEI for PACS would pose a huge economic burden on the health care system [9, 21]. Therefore, our views align with those of the ZAP trial and advise against blindly performing LPI or PEI. Close observation and serial gonioscopy appear to be a more reasonable management strategy.

The current study also found significant differences in the treatment choices for PACS between doctors from tertiary hospitals and those from secondary or lower-level hospitals, as well as between doctors from public and private hospitals, doctors with different professional titles, and doctors from the northern and southern regions. Notably, lower-level hospitals and private hospitals had more ophthalmologists who preferred PEI as the first-line treatment for PACS, while LPI was more frequently chosen in tertiary hospitals and public hospitals. One possible explanation for this finding is that PEI can offer greater potential for generating economic benefits, while variations in the laser equipment configurations across different hospitals may also contribute to the difference. Furthermore, senior doctors and residents exhibited a greater propensity for PEI, and residents also tended to opt for LPI. In contrast, attending doctors preferred RO as the primary strategy for managing PACS. This may be related to the fact that doctors with intermediate years of experience are most receptive to new research findings. Geographical location-based statistical analysis revealed that doctors from southern hospitals were inclined to favor LPI and PEI, while doctors from northern hospitals were more prone to adopt an observation approach. After adjustment for other potential confounding factors, a significant difference persisted between the northern and southern regions with respect to the selection of RO versus LPI. In the southern regions of China, which are relatively more economically developed, the higher utilization of aggressive treatments may also be attributed to their potential economic benefits. Intriguingly, despite the well-known ZAP trial conducted in a southern city of China, doctors from the southern region do not seem to have fully adhered to the research's recommendations in their clinical practice.

The present study showed that the top three considerations varied among ophthalmologists who selected different management strategy. These findings indicate that although doctors may have inherent preferences toward certain treatments for PACS, their choices are predominantly based on patients' anatomical characteristics and potential benefits. Previous studies

have focused on the anatomical factors that contribute to the progression of PACS. Specifically, Zhang's study [22] demonstrated that a narrower mean angle width and shallower limbal and central anterior chamber depth were associated with the progression of PACS. Similarly, the ZAP trial [23] reported that a narrower horizontal angle opening distance of 500 mm from the scleral spur, flatter horizontal iris curvature, and older age were significantly associated with progression. Furthermore, the Singapore Epidemiology of Eye Disease Study identified increasing age, higher intraocular pressure, and shallower anterior chamber as noteworthy risk factors for PACS progression [18]. All of the aforementioned studies provide better evidence for doctors to evaluate the risk of PACS progression in the future. Furthermore, our results demonstrate that patients' follow-up compliance is crucial for any treatment method, indicating that PACS is a chronic condition that requires regular follow-up rather than being cured once and for all.

This study has some limitations. Although the questionnaire survey reflects the clinical diagnosis and treatment status of PACS in China to some extent, as a result of uneven sample distribution across different groups, random stratified sampling could not be achieved. This may introduce some bias into the study results compared to the actual situation. Additionally, this study is initiated by a single center with a relatively small sample size. Further large-sample, multicenter investigations are needed to reinforce our conclusion or detect new perspectives.

CONCLUSIONS

This study investigated the current treatment preferences of PACS in China and concluded that the majority of ophthalmologists prefer aggressive treatments such as LPI or PEI over RO when dealing with patients with PACS. Many clinical factors influenced their treatment choices, and significant differences were identified among ophthalmologists based on their level of experience, hospital type, and geographical location. Given the complexity and

multifactorial nature of PACS management, there is no one-size-fits-all approach that is most suitable for all situations. The 2020 European Glaucoma Society guidelines [24] highlight the significance of management goals that encompass not only the improvement of patients' quality of life and well-being but also the prevention of severe visual function impairment. Thus, identifying high-risk indicators in patients with PACS and real high-risk populations in clinical practice should be the focus of future research.

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Author Contributions. Fei Yang and Huijuan Wu had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Concept and design: Huijuan Wu. Acquisition, analysis, or interpretation of data: Fei Yang and Huijuan Wu. Drafting of the manuscript: Fei Yang. Critical revision of the manuscript for important intellectual content: Fei Yang and Huijuan Wu. Statistical analysis: Fei Yang. Obtained funding: Huijuan Wu.

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Data Availability. The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Conflict of Interest. Fei Yang and Huijuan Wu declare that they have no competing interests.

Ethical Approval. The study was performed in accordance with the Helsinki Declaration of 1964 and its later amendments and approved by the Ethics Committee of Peking University People's Hospital (2018PHC011). All participants were aware of the collection of their data for this study and informed consent was obtained from each participant.

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