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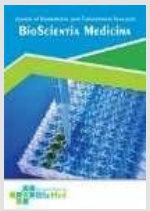

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The Difference of Lens Thickness in Acute and Chronic Primary Angle Closure Glaucoma

Sucyeka Syafutri[1*], Fitratul Ilahi[1]

[1]Department of Ophthalmology, Universitas Andalas/Dr. M. Djamil General Hospital, Padang, Indonesia

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***Corresponding author:**
Sucyeka Syafutri

E-mail address:
ucysiregar@gmail.com

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A B S T R A C T

Background: Lens thickness is one of the factors that influence the mechanism of acute primary angle closure glaucoma (PACG). The thicker lens usually results in a shallower anterior chamber angle (ACA), and the gradual and progressive increase in lens thickness with age results in exaggerated shallowing of the ACA. Because lens thickness has an important role in acute PACG mechanism, prophylactic treatment like lens extraction might prevent PACG in early stages. This study aimed to describe the difference in lens thickness in acute and chronic PACG. **Methods:** The research was a cross-sectional study with samples conducted in Dr. M. Djamil General Hospital from September-December 2019. The number of eyes that fulfilled the inclusion criteria were 50 eyes from 50 patients consisting of 25 eyes with acute PACG and 25 eyes with chronic PACG. Subjects were examined with ocular biometry using A-scan biometry to evaluate lens thickness. Data were processed and analyzed using a computer program with a chi-square test. **Results:** Mean of lens thickness in acute PACG is 5.02 ± 0.45, while in chronic PACG is 4.86 ± 0.40. The difference in lens thickness in acute and chronic PACG were statistically significant (p = 0,037). **Conclusion:** Lens thickness is thicker in acute PACG than in chronic PACG.

1. Introduction

Primary angle closure glaucoma (PACG) is primary glaucoma characterized by iridotrabecular contact >180° with increased intraocular pressure (IOP) or peripheral anterior synechia (PAS) with glaucomatous optic neuropathy and visual field defects. The worldwide prevalence of PACG is expected to reach over 23 million by 2020 and over 32 million by 2040. PACG is more common in women and certain ethnic groups, such as certain Asian populations. One study found a higher prevalence of PACG in East Asia than in Southeast Asia. Another study found the highest prevalence of PACG in the Asian population. In general, the prevalence of primary open-angle glaucoma (POAG) is higher than PACG, but many population-based studies have shown that PACG causes a threefold increased risk of severe visual impairment to blindness and is often bilateral after an acute attack. PACG is estimated to cause more than 90% of blindness due to glaucoma in the Chinese population.[1-4]

Pupillary block is the mechanism that most often occurs in PACG. Other causes, such as lens factors, are suspected to also play a role in the PACG mechanism. With age, the thickness of the lens increases, which can result in increased iridolenticular contacts, thereby increasing the risk of developing PACG. Based on the clinical manifestations experienced, PACG is divided into acute PACG and chronic PACG. Acute PACG patients usually

experience sudden eye pain, whereas in chronic PACG patients, it is usually asymptomatic.[1,5] This study aimed to determine the difference in lens thickness in acute and chronic PACG.

2. Methods

This research was conducted at the glaucoma polyclinic tertiary education hospital, Dr. M. Djamil General Hospital, Padang, for 4 months, namely September-December 2019. This research was conducted after obtaining approval from the Ethics and informed consent from the patient. This study is an observational study with a cross-sectional approach sampling is carried out consecutive sampling. The number of study samples was 50 eyes from 50 patients consisting of 25 eyes with acute PACG and 25 eyes with chronic PACG.

Patients who belong to the acute PACG group, namely patients who experience acute complaints such as eye pain, headache, blurred vision, seeing halos around light sources, IOP increases >35 mmHg, accompanied by red eyes, corneal edema, anterior chamber shallow, with a mid-dilated, unreactive pupil. Patients belonging to the chronic PACG group are patients with PAS >180ºC with anterior chamber shallow, and there is chronically elevated IOP with accompanying glaucomatous optic neuropathy and visual field defects. Chronic PACG is usually asymptomatic or may have occasional headaches. Patients with a history of intraocular surgery, history of ocular trauma, active keratitis, and corneal opacity/scarcity were excluded from this study.

In patients with acute PACG, medical therapy is given first, then a thorough ophthalmological examination, including biometry, is performed after the patient's acute condition is sufficiently calm. A thorough ophthalmological examination was performed by an ophthalmologist in the form of a visual examination using the Snellen chart, examination of the anterior segment with slit lamp Carl Zeiss, gonioscopy examination using Sussman four mirror goniolens, examination of the posterior segment with Keller direct ophthalmoscope, examination of IOP with Goldmann applanation tonometry, and examination of lens thickness was measured using contact ultrasonic biometry Tomey by placing the probe over the central cornea. Field check with SITA standard performed using Humphrey's automated Perimetry. The collected samples were subjected to statistical analysis with SPSS using the Chi-Square test to compare categorical variables and the T-test independent to compare numeric variables, with p-value < 0.05.

3. Results

A sample of 50 eyes from 50 patients in this study was divided equally into each group. When comparing the mean age of the two groups, it was found that patients in the acute PACG group were older than patients in the chronic PACG group (61.64 ± 9.16 VS 58.36 ± 8.95, P = 0.207). Comparing gender distribution between the two groups, it was found that women dominated both the acute PACG group (84%) and the chronic PACG group (76%), with P=0.48 (table 1). A comparison of family history of glaucoma in the two groups found that the acute PACG group had less family history of glaucoma than chronic PACG (40% VS 72%, P= 0.023).

Table 1. Comparison of age, gender, and family history of glaucoma.

Variable	Acute PACG	Chronic PACG	P
Age, mean ± SD	61.64 ± 9.16	58.36 ± 8.95	0.207
Male, n (%)	4 (16%)	6 (24%)	0.480
Female, n (%)	21 (84%)	19 (76%)	
FHG, n (%)	10 (40%)	18 (72%)	0.023
No FHG, n (%)	15 (60%)	7 (28%)	

SD: Standard deviation; FHG: Family history of glaucoma.

The results of lens thickness examination using contact ultrasonic biometry found that the acute PACG group had an average thicker lens thickness than the chronic PACG group, with statistically meaningful differences in values (5.02 ± 0.45 VS 4.86 ± 0.40, P = 0.037).

Table 2. Comparison of lens thickness.

Variable	Mean ± SD		P
	Acute PACG	Chronic PACG	
Lens thickness (mm)	5.02 ± 0.45	4.86 ± 0.40	0.037

4. Discussion

In this study, it can be seen that the acute PACG group had an average older age than the chronic PACG group, although this difference was not statistically significant (61.64 ± 9.16 VS 58.36 ± 8.95, P = 0.207). In general, the average age obtained in these two groups is in the elderly category, and all samples are above the age of 40 years. Previous research has proven that old age is one of the predisposing factors that play a role in the development of PACG. The prevalence of angle closure anterior chamber increases every decade after the age of 40. This is due to an increase in lens thickness and forward movement with age which can result in increased iridolenticular contacts. PACG rarely occurs in people under 40 years of age, and if it does, the etiology of PACG in young individuals is most often related to anatomic abnormalities such as plateau iris.[1-5]

It is well known that PACG is gender predisposed, i.e., women are more at risk than men. Likewise, in the results of this study, it was found that women dominated both the acute PACG group (84%) and the chronic PACG group (76%), with P =0.48 (Table 1). PACG is more prone to occur in women than men because women tend to have smaller anterior segment sizes and axial length, which is shorter than male.[1,6]

PACG is a disorder that is known to be related to hereditary factors. Therefore, anamnesis regarding family history was recorded and statistically processed to be compared between the two groups. In this study, it was found that the acute PACG group had a family history of having less glaucoma than the chronic PACG group (40% VS 72%, P= 0.023). The incidence of PACG is increased in first-degree relatives of affected individuals. In white individuals, the prevalence of PACG in first-degree relatives has been reported to be between 1% and 12%, whereas survey results in the Chinese population indicate that the risk is 6 times higher in patients with a family history. In Inuit people, the relative risk of people with a family history is increased by 3.5 times compared with the Inuit population with no family history of glaucoma. The existence of this family history factor is associated with genetic influences on the occurrence of PACG. Amerasinghe et al. (2011) found that 60% of siblings of PACG patients were estimated to be 7 times more at risk of having a narrow angle than the general population.[1,7,8]

Analysis of the average lens thickness showed a statistically significant difference between the two groups, with acute PACG having an average thicker lens thickness than those with chronic PACG (5.02 ± 0.45 VS 4.86 ± 0.40, P = 0.037). This is in line with research conducted by Krishnankutty et al. (2019), who found that the average thickness of the lens in acute PACG was thicker than in chronic PACG, and the results were statistically significant (P<0.001). Thick lenses can cause the anterior chamber to become shallow so that angle closure can occur. Razeghinejad et al. (2013) in their study also found statistically significant differences in acute PACG lens thickness (P < 0.0001). Lan et al. (2007) said that lens thickness plays a role in the occurrence of acute PACG because, in their research, it was found that eyes with acute PACG have thicker lenses than eyes with chronic PACG.[9,10,11]

The thickening of the lens, which is usually associated with increasing age, can cause a narrowing of the anterior angle chamber. Lens fiber are known to grow throughout age and, in old age, will cause

cloudiness and thickening of the lens. This, in turn, will lead to the thickness of the lens in the elderly group becoming thicker when compared to lenses that have not experienced turbidity. One of the mechanisms of acute PACG pathogenesis is caused by the anterior position and the large thickness of the lens, which can reduce the anterior depth chamber, increasing contact with the iris, pressing and pushing on the peripheral iris and ciliary body, then pushing these structures towards trabecular meshwork and lead to acute and chronic angle closure glaucoma. Chronic PACG courses through the slow formation of PAS and a narrowing of the anterior angle chamber due to the encouragement of the lens, which thickens it slowly, causing an increase in IOP, which will mechanically from cupping glaucomatous and if there are triggering factors, it will immediately become acute PACG.[6,12,13,14]

5. Conclusion

Acute PACG had a thicker average lens thickness than the chronic PACG group.

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