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ORIGINAL ARTICLE

Phacoemulsification Results of Eyes with Primary Angle Closure and Primary Angle Closure Glaucoma Using the Pentacam System

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ABSTRACT

Aim: To evaluate the phacoemulsification results of patients with primary angle closure (PAC) and primary angle closure glaucoma (PACG) using the Pentacam system.

Method: This retrospective cohort study included patients with PAC and PACG who underwent phacoemulsification and intraocular lens implantation between 2018 and 2021 in one tertiary center. Anterior chamber parameters measured using the Pentacam system and gonioscopic and intraocular pressure (IOP) changes were evaluated preoperatively and postoperatively.

Results: Nineteen eyes of 13 patients with PAC and PACG were included in the study. The mean age of the patients was 63.2 years, and 30.8% were male. The mean preoperative and postoperative third-month IOP was 21.0 ± 7.4 mmHg (11-40) and 13.7± 2.5 mmHg (9-18), respectively ($p<0.01$). The mean preoperative anterior chamber angle (ACA) measured by the Pentacam system was 21.07 ± 4.16° (13-27). The mean preoperative anterior chamber depth (ACD) and the anterior chamber volume (ACV) measured by the Pentacam system were 1.79 ± 0.24 mm (1.39-2.22) and 72.55 ± 20.64 mm^3 (45-109), respectively. The postoperative third-month topographic measurements were as follows: mean angle, 35.76 ± 7.32° (20.1-46.9); mean ACD, 3.52 ± 0.95 mm (1.15-4.46); and mean ACV, 133.21 ± 25.21 mm^3 (81-173) ($p<0.01$).

Conclusion: Pentacam is a useful system to evaluate anterior segment changes after phacoemulsification in patients with PAC and PACG. Phacoemulsification was found to result in significant IOP reduction in these patients.

Keywords: glaucoma, angle closure, phacoemulsification, intraocular pressure.

INTRODUCTION

The Pentacam system (Oculus, Wetzlar, Germany) has two rotating Scheimpflug cameras; one is central to detect the pupil and controls fixation and the other stands on the rotating wheel to capture the images of the anterior segment [1]. This is a non-contact measurement system that acquires 50 images in 2 seconds and creates a 360-degree limbus to limbus three-dimensional picture of the anterior segment [2]. In clinical practice, it has a wide range of applications, including the evaluation of the cornea for refractive surgery, pachymetry, assessment of lens density, quantification of posterior capsule opacification, intraocular lens (IOL) calculation, and glaucoma screening [1].

Pachymetry provides values that are used for intraocular pressure (IOP) correction formulas. The anterior chamber depth (ACD) and anterior chamber volume (ACV) are reliable screening measurements for narrow angles. However, the measurement of the anterior chamber angle (ACA) with Pentacam only gives an estimation because reflectance from the scleral spur prevents the direct visualization of the angle [1].

IOP reduction after phacoemulsification (PE) has been known for three decades [3,4]. The IOP reduction after PE is greater when the subject has an occludable angle [5]. The lens plays an important role in the pathophysiology of PACG by both aggravating pupillary block and creating a crowded anterior chamber in relatively smaller eyes [6]. For many years, standard care for PAC and PACG was accepted as laser peripheral iridotomy (LPI) to relieve pupillary blocks, medical anti-glaucomatous therapy to reduce IOP, and filtrating operations when other treatments were insufficient [6]. However, a prospective, multicenter, randomized, controlled study called the EAGLE (Effectiveness in Angle-closure Glaucoma of Lens Extraction) protocol, including 155 primary angle closure and 263 primary angle-closure glaucoma cases, stated that clear lens extraction was more efficacious and cost-effective than LPI [7]. Many later reports have also shown IOP reduction after PE surgery in PAC and PACG cases with cataracts or clear lenses [6,8,9].

In PAC and PACG cases, PE surgery is very challenging due to the shallow anterior chamber limiting the space for manipulation [10]. Complications are likely, especially in the capsulorhexis and during different stages of PE surgery. A high preoperative IOP and possible intraoperative pupillary block may lead to suprachoroidal hemorrhage, which is the worst scenario [11]. Increased risk of endothelial loss and peroperative Descemet membrane detachment are among the PE-related complications in eyes with shallow anterior chambers. For these reasons, PE in these shallow anterior chambers is challenging, and thus the timing of surgery should be carefully planned and preoperative preparation should be meticulously undertaken [12].

In this study, we evaluated the results of PE in eyes with PAC and PACG with respect to IOP changes, glaucoma drug use, complications, and changes in anterior chamber parameters using the Pentacam measurements of the patients.

METHODS

This is a retrospective cohort study investigating the PE results of patients with PACG and PAC and shallow anterior chambers between 2018 and 2021 in the ophthalmology clinic of a tertiary center.

Patients with PAC or PACG were included in the study when a visually disturbing cataract and a shallow anterior chamber were detected in their ophthalmologic examination. All the patients underwent a full ophthalmologic examination, gonioscopy with a Zeiss 4 mirror gonioscopy lens, IOP measurements with applanation tonometry, and the visual field test using the 24-2 Swedish interactive threshold algorithm (Humphrey Visual Field Analyzer, Carl Zeiss Meditec, Dublin, CA, USA). The gonioscopy scores were recorded in the Schaffer grading system. The mean deviation value of the visual field test was also noted. Patients with very shallow anterior chambers and extensive peripheric anterior synechia and elevated IOP requiring combined PE and trabeculectomy were not included in the study. In addition, patients with other ophthalmic pathologies, including corneal opacity, those with secondary angle closure glaucoma, e.g., phacomorphic glaucoma, and those with retinal pathologies were excluded from the study.

Medical records were reviewed, and the demographic characteristics of the patients and preoperative manifest refraction in spherical equivalent were recorded. The preoperative and postoperative third-month vision was examined with the Snellen chart converted into logMAR. The cup-to-disc ratio, visual field mean deviation, axial length measured with IOL Master (Carl Zeiss Jena, Germany), results of the gonioscopic examination performed with the Zeiss 4 Mirror Gonioscopy lens, retinal nerve fiber layer (RNFL) measurements undertaken with the Heidelberg Spectralis OCT (Heidelberg Engineering, Dossenheim Heidelberg, Germany) RNFL thickness protocol, and anti-glaucomatous drug use were recorded. In cases of fixed-combination drug use, the number of active anti-glaucomatous molecules was recorded. The preoperative and postoperative third-month anterior segment parameters were examined with the Pentacam system (Oculus, Wetzlar, Germany), including ACA in degrees, ACD in mm, and ACV in mm^3. The preoperative and postoperative first-week, first-month, and third-month IOP measurements were evaluated. The operation notes and patient files were reviewed to see if any peroperative and postoperative complication occurred.

All PE operations were performed by two well-experienced anterior segment surgeons. The patients were instructed to lie supine for an hour before surgery and were transferred to the operating room in supine position. Preoperatively, 1 mg/kg 20% mannitol intravenous infusion was given to all the patients, and pupil dilatation was achieved over 30 minutes before the patient was taken to the operating room. Postoperatively, all anti-glaucomatous drugs were stopped according to the IOP measurements and restarted if IOP increased during the follow-up visits. All the patients were instructed to use antibiotic eye drops for 15 days and steroid eye drops for one month postoperatively.

Surgical Technique

All the procedures were performed under sub-Tenon's anesthesia with a mixture of 3.5-5 ml 2% lidocaine and 0.5% bupivacaine. Superior clear corneal incisions were used. Side ports were opened at 2 and 10 o'clock positions. As a dispersive viscoelastic agent, sodium hyaluronate 3% and chondroitin sulfate 4% (Viscoat; Alcon) were used in all cases for endothelial protection. The Alcon infiniti phacoemulsification system (Alcon, Forth Worth, Texas, USA) was used in all cases. The phaco-chop technique was applied. Bimanual irrigation and aspiration were performed, and a foldable hydrophobic acrylic intraocular lens was implanted in the capsular bag. After careful viscoelastic removal, antibiotic prophylaxis was administered to the anterior chamber.

The primary outcome measures were preoperative and postoperative changes in IOP and Pentacam measurements, including ACA, ACD, and ACV. Secondary outcome measures were changes in anti-glaucomatous drug use, gonioscopy scores, and complications related to PE.

The study was approved by the Clinical Research Ethical Committee of Haydarpasa Numune Training and Research Hospital (HNEAH-KAEK-2021/319-3371-13.12.2021) and adhered to the ethical principles of the Declaration of Helsinki.

Statistical Analysis

The data were evaluated with statistical software package IBM SPSS Statistics Standard Concurrent User v 26 (IBM Corp., Armonk, New York, USA). Descriptive statistics were given as number of units (n), percentage (%), mean ± standard deviation (x ± SD), median (M), interquartile range (IQR), minimum (min), and maximum (max) values. The distribution of differences in numerical variables was evaluated with the Shapiro-Wilk test of normality. The homogeneity of variances was evaluated with Levene's test. The paired-samples t-test was used for the preoperative and postoperative comparisons of the RNFL, ACA, ACD, ACV, and LogMAR values, and the Wilcoxon test was used for the preoperative and postoperative comparisons of the gonioscopy scores and the cup-to-disc ratio. The IOP values were compared with one-way repeated-measures analysis of variance. The Bonferroni correction was applied in post hoc tests. Fisher's exact test was used for the comparison of preoperative and postoperative drug use since the table size was 5 x 4 in size. Simple and multiple linear regression analyses were used to determine factors affecting % changes in IOP. The gender variable was included in the regression models as a dummy variable. In the multiple linear analysis, the final model was determined with the backward method. The suitability of the model established for the linear regression analysis was examined with the Shapiro-Wilk normality test, the Q-Q plot was constructed to check the normality of residuals, and tolerance and variance inflation factor (VIF) statistics were used for collinearity. The necessary assumptions for the regression model were met. According to the post-power analysis of our data, effect size was calculated as 0.849 and statistical power was found to be 92.6%, and therefore sample size was considered to be sufficient. A p value of <0.05 was accepted as statistically significant.

RESULTS

The descriptive characteristics of the study subjects and eyes are shown in Table 1. The study included 19 eyes of 13 patients. Four patients (30.8%) were male, and nine (69.2%) were female. Nine (47.4%) eyes were classified to have PAC, and the remaining eyes had PACG. The patients' ages ranged from 47 to 72 years, and the median age was 66 years.

Table 1. Statistics on the demographic characteristics of the patients and eyes

Variables	Statistics
Gender. *n* (%)	
Male	4 (30.8)
Female	9 (69.2)
Age. (years)	
Mean ± SD	63.2 ± 8.5
M (min-max)	66.0 (47.0-72.0)
Eyes. *n* (%)	
Right	9 (47.4)
Left	10 (52.6)
Spherical equivalent. *n* (%)	
Myopia	2 (15.4)
Hypermetropia	17 (84.6)
Spherical equivalent. (diopter)	
Mean ± SD	2.23 ± 1.31
CCT (μm)	
Mean ± SD	538.5 ± 21.2
Visual field MD (decibel)	
Mean ± SD	-5.41 ± 9.42
Preop cup-to-disc ratio	
Mean ± SD	0.55 ± 0.25
Postop cup-to-disc ratio	
Mean ± SD	0.56 ± 0.26
Preop anti-glaucomatous drug *n* (%)	
None	9 (47.4)
One molecule	1 (5.3)
Two molecules	3 (15.7)
Three molecules	1 (5.3)
Four molecules	5 (26.3)
Postop anti-glaucomatous drug *n* (%)	
None	9 (47.4)
One molecule	6 (31.6)
Two molecules	3 (15.7)
Three molecules	1 (5.3)
Preop gonioscopy grade (Schaffer)	
Grade 1	15 (78.9)
Grade 2	4 (21.1)
Postop gonioscopy grade (Schaffer)	
Grade 3	3 (15.8)
Grade 4	16 (84.2)
Axial length (mm)	
Mean ± SD	21.8±0.3
Laser iridotomy	
n (%)	8 (42.1)

SD: standard deviation, M: median, min: minimum, max: maximum, CCT: central corneal thickness, preop: preoperative, postop: postoperative, MD: mean deviation.

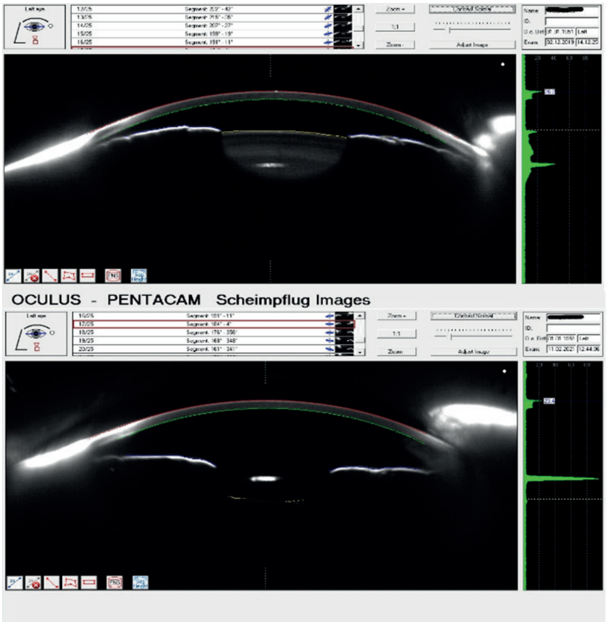

Figure 1. Scheimpflug images. Top; Before PE surgery, bottom; after PE surgery.
Abbreviation: PE: phacoemulsification.

Eight (42.1%) eyes had previously undergone laser peripheric iridotomy.

Ten (52.6%) eyes were left eyes. The spherical equivalent mean was 2.23 ± 1.31 diopter. The mean central corneal thickness was 538.5 ± 21.2 μm. Preoperatively, the number of eyes in which four topical anti-glaucomatous molecules were used was 5 (26.3%). The number of eyes with a preoperative gonioscopy score of 1 was 15 (78.9%). The mean preoperative mean deviation value in the visual field test was -5.41 ± 9.42 decibel. The mean preoperative cup-to-disc ratio was 0.55 ± 0.25. The mean postoperative cup-to-disc ratio was 0.56 ± 0.26, and the change was not significant ($p > 0.05$, Wilcoxon signed-rank test).

The preoperative and postoperative mean values of RNFL and Pentacam measurements and logMAR values are presented in Table 2. The decrease in the postoperative values for RNFL was not statistically significant ($p > 0.05$). Postoperative ACA, ACD, and ACV measurements were statistically higher than preoperative values ($p<0.001$), which were remarkable in Scheimpflug images (Figure 1). The postoperative logMAR values were statistically lower than the preoperative values ($p < 0.05$).

Using Fisher's exact test, the distribution of the preoperative and postoperative anti-glaucomatous drug use differed at a statistically significant level ($p < 0.05$). While the number of eyes in which four

Table 2. Comparison of the preoperative and postoperative measurements

	Measurements		Test Statistics	
	Preoperative *Mean ± SD*	Postoperative *Mean ± SD*	*t*	*p*
RNFL (µm)	86.42 ± 19.08	85.05 ± 19.98	1.950	0.067
ACA (degree)	21.07 ± 4.16	35.76 ± 7.32	8.548	<0.001
ACD (mm)	1.79 ± 0.24	3.52 ± 0.95	7.390	<0.001
ACV (mm^3)	72.55 ± 20.64	133.21 ± 25.21	12.093	<0.001
logMAR	0.457 ± 0.469	0.142 ± 0.353	3.604	0.002

SD: standard deviation, t: paired-samples t-test, RNFL: retinal nerve fiber layer, ACA: anterior chamber angle, ACD: anterior chamber depth, ACV: anterior chamber volume.

Table 3. Simple linear regression analysis of factors affecting % change in IOP

	β	*C.I.* for *β*	*t*	*p*
Preop IOP	3.376	2.235-4.516	6.245	**<0.001**
Gender*				
Female	Reference			
Male	20.599	1.446-39.752	2.280	**0.037**
Age*	0.394	-0.637-1.426	0.810	0.430
CCT*	-0.143	-0.557-0.270	-0.735	0.473
Preop RNFL*	-0.181	-0.685-0.322	-0.764	0.456
Preop ACA*	2.064	0.196-3.932	2.342	**0.032**
Preop ACD*	13.515	-23.443-50.474	0.775	0.450
Preop ACV*	0.095	-0.337-0.527	0.465	0.648
Preop logMAR*	-15.867	-33.908-2.173	-1.865	**0.081**

*Adjusted for preoperative IOP.

β: regression coefficient, CI: confidence interval, IOP: intraocular pressure, preop: preoperative, CCT: central corneal thickness, RNFL: retinal nerve fiber layer, ACA: anterior chamber angle, ACD: anterior chamber depth, ACV: anterior chamber volume.

anti-glaucomatous molecules were used in the preoperative period was 5 (26.3%), there were no eyes in which four anti-glaucomatous molecules were used in the postoperative period. In addition, one anti-glaucomatous molecule was used in one (5.3%) eye in the preoperative period and six eyes (31.6%) in the postoperative period.

The postoperative gonioscopy scores were statistically higher than the preoperative gonioscopy scores. According to the Schaffer grading system, the median preoperative gonioscopy score was 1 and the postoperative median gonioscopy score was 4 ($p < 0.001$).

The IOP values statistically significantly differed between the measurement times. The preoperative, postoperative first-week, postoperative first-month, and postoperative third-month mean IOP values were 21.0 ± 7.4 mmHg, 16.3 ± 3.7 mmHg, 13.6 ± 2.5 mmHg, and 13.7 ± 2.5 mmHg, respectively. The postoperative first- and third-month IOP values were statistically lower than the preoperative values ($p < 0.001$). The differences between the remaining measurements were not statistically significant. Figure 2 presents the IOP change curve with time.

When the preoperative and postoperative third-month IOP values of the patients were evaluated as percent changes, the median percent change was 35.0% (IQR: 50.0). Table 3 presents the results of the simple linear regression analysis of the factors considered to affect the percent change in IOP. In this analysis, preoperative IOP was found to be a confounding variable.

Parameters with a p value of <0.20 in the simple linear regression analysis were included in multiple linear regression analysis (Table 4). According to the results, gender, preoperative ACA, and preoperative logMAR affected the percent change in IOP. As the preoperative IOP values increased, the percentage of change also increases. The IOP change in men was greater than in women. In addition, as the

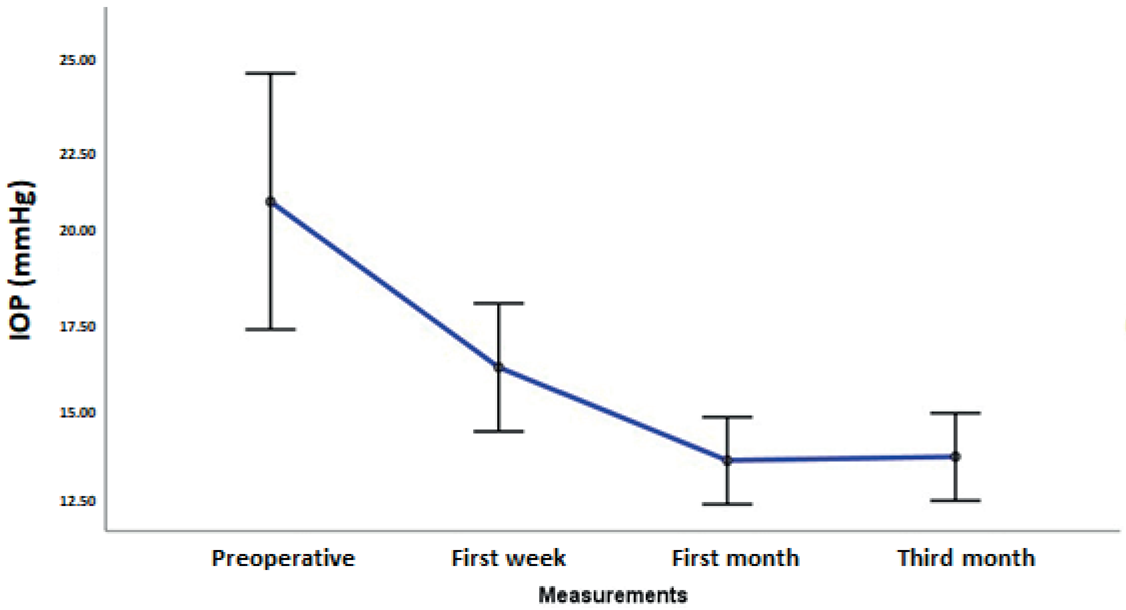

Figure 2. Changes in IOP values over time. Abbreviation: IOP: intraocular pressure.

Table 4. Multiple linear regression analysis for factors affecting % change in IOP

	β	*C.I.* for *β*	*t*	*p*	R^2	Adjusted R^2
Constant	-74.953	(-111.629)-(-38.277)	-4.383	0.001	0.870	0.833
Preop IOP	3.266	2.357-4.176	7.703	<0.001		
Gender						
Female	Reference					
Male	14.026	2.254-30.627	2.201	0.045		
ACA	1.748	0.113-3.383	2.294	0.038		
Preop logMAR	-16.717	(-30.887)-(-2.546)	-2.530	0.024		

β: Regression coefficient; C.I.: Confidence interval; Modeled factors: Preop IOP, Gender, Preop Angle, Preop logMAR Method: Backward.
IOP: intraocular pressure; Preop: preoperative; ACA: anterior chamber angle.

preoperative ACA degree increased, the amount of IOP change increased, and as the preoperative logMAR value increased, the amount of change decreased. The model established according to the adjusted R^2 value explained 83.3% of the change in IOP.

No peroperative complications were seen. In one patient, postoperative aqueous misdirection syndrome occurred, which was resolved with 1% atropine treatment applied four times per day.

DISCUSSION

The lens factor plays an important role in both the pupillary block mechanism and angle closure in PAC and PACG. Eyes with PAC and PACG have thicker, more anteriorly positioned lenses than healthy eyes [13]. Many studies have shown that PE is useful for IOP reduction in PAC and PACG. As PE deepens ACD and widens the iridotrabecular angle, it both decreases the pupillary block and opens the angle [14]. However, PE alone may not be sufficient to control IOP adequately in patients with uncontrolled PACG. It is postulated that ultrastructural changes in the trabecular meshwork that have already occurred diminish drainage through the meshwork even if the angle is open. Studies have reported that up to 20% of these patients will require a filtering procedure [15], and 25% may progress after PE [16]. Moreover, the risk of postoperative IOP spikes probably limits the indications for PE alone in patients with advanced, uncontrolled PACG. In such cases, phaco-trabeculectomy may be a better option [15].

In our study, the mean IOP decreased from 21 mmHg to 13.7 mmHg at the postoperative third month (p < 0.01). The decrease in IOP was significant at the postoperative first and third months. Although there was also a decrease in the first week, this was not statistically significant. This finding probably reflects the postoperative effect of topical steroid drops. Since anti-glaucomatous drugs had not yet been started, higher IOP readings may have been obtained at the first week than the first and third months. We found a significant decrease in the number of anti-glaucomatous drugs used at the third month. This significant decrease in IOP and the number of anti-glaucomatous drugs is very important in glaucoma control. During aging, cataracts become universal, and PE should be considered when indicated for its beneficial effect on glaucoma control in PAC and PACG cases [17].

In the EAGLE trial, clear lens extraction in PAC cases with an IOP of >30 mmHg and PACG was shown to be more efficacious and cost-effective than the classical approach including LPI and medical therapy. PE technology has improved to a great extent in the last few decades, and the use of this technology as a refractive procedure has become very common across the world. Thus, clear lens extraction as a treatment and prophylaxis in patients with PAC and PACG has gained popularity in recent years [6,11,14].

Trabeculectomy is better for IOP control in PACG, but it involves very important vision-related and eye-threatening complications in narrow angles, including suprachoroidal hemorrhage, choroidal detachment, malignant glaucoma, postoperative extended hypotony, and endophthalmitis [15]. However, the PE procedure is also not complication-free. It is especially challenging in eyes with PAC and PACG due to the shallow anterior chamber, high IOP, insufficient pupil dilatation, and sometimes posterior synechia creating difficulties in every step of the surgery. In particular, endothelial deficiency may be an important problem postoperatively [17]. Surgeon experience in the manipulative steps of PE surgery can spare the visual function of patients.

In our series, we observed no intraoperative complications. All the operations were performed by two well-experienced anterior segment surgeons. In addition to surgeon experience, preoperative 20% mannitol infusion, late pupil dilatation, and patients being placed in supine position for an hour may have had an effect on the absence of complications. In the literature, the vitreous tap technique has been reported to eliminate positive vitreous pressure, deepen the anterior chamber, and overcome infusion misdirection syndrome [12]. We did not experience peroperative infusion misdirection syndrome, and we did not use the vitreous tap technique. In one patient, postoperative malignant glaucoma developed, which was resolved by early topical atropine treatment.

In the current study, the mean RNFL values measured preoperatively and postoperatively and the cup-to-disc ratios did not significantly change. ACA measured by Pentacam increased from 21 degrees to 35.7 degrees ($p < 0.001$), the mean ACD from 1.7 to 3.5 mm ($p < 0.001$), and the mean ACV from 73.5 to 133.2 ($p < 0.001$). Crystalline lens removal and IOL implantation widen the iridotrabecular angle, deepen the anterior chamber, and increase the chamber volume. These results are in concordance with other previous reports using Pentacam, anterior segment-optical coherence tomography (OCT), and ultrasonic biomicroscopy [9,18].

In our study, all the patients had visually significant cataracts. Not all the cases fulfilled the routine 0.4 logMAR or above criteria, but PE was indicated with the motivation of IOP control with better corrected visual acuity. No decrease in visual acuity was detected, but vision remained the same in one patient with advanced PACG.

According to our simple linear regression analysis, a high preoperative IOP, male gender, and high ACA and logMAR values had an effect on percent IOP change at the p value of <0.2. The multiple linear regression analysis with these variables revealed preoperative IOP as a confounding factor. As the preoperative IOP increased, the percent decrease in the IOP values increased, and this affected the other variables. In the analysis, the male patients had greater IOP percent change, and as the preoperative ACA value increased, the percent change increased and as the logMAR value increased, the percent change decreased (adj R^2: 0.83).

In our review of the literature, we found differences in factors affecting IOP change with cataract surgery. Dada et al. [14] reported that the only factors positively correlated with postoperative change in IOP in PACG eyes were preoperative IOP and ACD. Huang et al. [19] determined that preoperative lens vault appeared to be a significant factor in angle widening and IOP reduction after PE.

The authors also suggested that normal eyes with a shallower ACD and narrower ACA were more likely to achieve greater angle opening after cataract removal. However, Liu et al. [20] found a positive correlation between a higher preoperative IOP and ACD and postoperative IOP in PACG after cataract surgery. Liu et al. did not identify preoperative gonioscopic findings to be a determinant of postoperative IOP levels and attributed this to three reasons. First, it is not possible to determine the real extent of peripheric anterior synechia in the presence of a shallow anterior chamber and cataract. Second, surgical manipulations like viscoelastic injection may resolve synechia. Lastly, gonioscopic findings may not reflect the extent of trabecular damage since the loss of trabecular cells and irregular architecture affect outflow facility. On the other hand, Selvan et al. [21] found that swept source-OCT derived circumferential iridotrabecular contact index was the single best parameter to indicate the preoperative angle status and predict postoperative change in IOP.

In the current study, we found that higher preoperative ACA levels were associated with a higher percent decrease in IOP. The limitation of Pentacam in the visualization of the anterior chamber angle is known. The scleral scattering of incident light blocks angle visualization by the Pentacam system. On the other hand, angle estimation using Pentacam software provides a significant increase in angle width after PE, which is parallel with the literature. However, we consider that in addition to the measured angle width, the functional status of the trabeculum is also an important determinant of postoperative IOP levels after PE. The extent of trabecular damage and outflow facility may affect the association between higher preoperative ACA measurements and higher postoperative IOP decrease.

In our multiple linear regression analysis, we found higher preoperative logMAR values correlated with lower pressure change. A higher peroperative logMAR value is probably related to a higher cataract grade or glaucoma level. The exact role of visual acuity, cataract grade, and glaucoma level on postoperative IOP change is somewhat intriguing. Due to the limited number of patients in our cohort and PACG and PAC providing different levels of vision, it was not possible to fully reveal the role of LogMAR values in IOP change. To determine this exact relationship, there is a need for prospective controlled studies with larger patient populations.

CONCLUSION

In eyes with PAC and PACG, PE surgery offers significant IOP reduction and decreases anti-glaucomatous drug use. The preoperative and postoperative ACD, ACA, and ACV values measured on Pentacam indicate changes after PE. In the current study, all the ACD, ACA, and ACV measurements significantly increased after PE. A higher preoperative IOP and a higher ACA are significantly correlated with a greater decrease in IOP after PE surgery. In the current study, PE was found to be useful to reduce IOP, and Pentacam was useful in the demonstration of changes after PE in patients with PAC and PACG.

Author contribution

Study conception and design: YÜ and DC; data collection: YÜ and DC; analysis and interpretation of results: YÜ and DC; draft manuscript preparation: YÜ. All authors reviewed the results and approved the final version of the manuscript.

Ethical approval

Clinical Research Ethical Committee of Haydarpasa Numune Training and Research Hospital (HNEAH-KAEK-2021/319-3371-13.12.2021).

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Conflict of interest

The authors declare that there is no conflict of interest.

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