ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 15, Issue 12, 2022

Online - 2455-3891
Print - 0974-2441

Research Article

TO ASSESS THE ANTERIOR CHAMBER PARAMETERS USING PENTACAM IN PRIMARY ANGLE CLOSURE SUSPECTS FOLLOWING PERIPHERAL LASER IRIDOTOMY

MONIKA NETAM[1], RAJINDER SINGH[1]*, SURINDER KAUR[2], JATIN THUKRAL[1], HARBIR KAUR[1], SURMILA MEENA[1], PAWANDEEP KAUR[1]

[1]Department of Ophthalmology, Government Medical College, Patiala, Punjab, India. [2]Department of Pedodontics, Government Dental College, Patiala, Punjab, India. Email: rajindersingh76763@yahoo.in

Received: 25 June 2022, Revised and Accepted: 10 September 2022

ABSTRACT

Objective: The aim of the present study was to study the changes in anterior chamber parameters before and after laser peripheral iridotomy (LPI) in primary angle closure suspects (PACS) using pentacam.

Methods: This was a prospective, non-randomized, and interventional study which was conducted on 40 patients of PACS attending the Outpatient Department of Ophthalmology, Government Medical College, Patiala. Evaluation of the anterior segment of the eye was done by Pentacam (Oculus) using rotating Scheimpflug imaging technology, before and after LPI.

Results: Following LPI, anterior chamber volume (ACV) increased from 90.13±9.82 mm^3 to 105.8±11.5 mm^3; anterior chamber angle (ACA) increased from 27.01±3.23 degree to 28.13±2.29 degree. Peripheral anterior chamber depth (PACD) at 4 mm increased significantly in superior, inferior, nasal, and temporal quadrant in all cases.

Conclusion: LPI serves both prophylactic and therapeutic benefit in PACS by increasing the ACV, ACA, and PACD, and thus preventing glaucoma. Pentacam is a useful tool to assess the efficacy of LPI and can guide further course of treatment.

Keywords: Primary angle-closure suspects, Laser peripheral iridotomy, Pentacam, Glaucoma, Anterior chamber.

 DOI: http://dx.doi.org/10.22159/ajpcr.2022v15i12.45619. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

Glaucoma is a chronic, progressive optic neuropathy caused by a group of ocular disorders that lead to the damage of the optic nerve with loss of its function [1]. Glaucoma is progressive and if left untreated, will lead to blindness [2].

It has been widely accepted over the past several decades that primary glaucoma consists of two major subtypes: Primary open-angle glaucoma and primary angle-closure glaucoma (PACG) [2,3].

The new classification of PAC disease is as follows:

1. PAC suspects (PACSs): >270° of iridotrabecular contact plus absence of peripheral anterior synechiae (PAS) plus normal intraocular pressure (IOP), disk, and visual field
2. PAC: >270° of iridotrabecular contact with either elevated IOP and/or PAS plus normal disk and visual field examinations
3. PACG: >270° of iridotrabecular contact plus elevated IOP plus optic nerve and visual field damage. The angle is abnormal in structure and function, with optic neuropathy [4].

Anatomical features such as shallower central anterior chamber depth (CACD), narrow anterior chamber angle (ACA), shorter axial length, greater lens thickness, and smaller radius of corneal curvature are the major risk factor for developing PAC [5-9].

Risk factors involved are as follows: Stronger risks – female gender, hyperopia, shallow peripheral anterior chamber, second eye having angle closure, Inuit and Asian ethnicity; weaker risks – advanced age, family history, and use of medications that induce angle narrowing.

Mechanism of angle closure

Pupillary block mechanism

According to Tiedeman's theory about the physical factors affecting iris contour [10], pupillary block is an exaggeration of a physiological phenomenon, in which the flow of aqueous from the posterior chamber through the pupil to the anterior chamber is impeded causing the pressure in the posterior chamber.

Non-pupil block mechanism

It involves configurations of the peripheral iris, damage to the trabecular meshwork, anatomical features of the ciliary body and suprachoroidal space, thickness and position of the lens, and movement of iris-lens diaphragm [11-13].

Iris and ciliary body

Anteriorly rotated ciliary body as well as bulky peripheral iris can play important roles in keeping angles narrow.

Lens-related mechanisms

A generally thicker lens with a relatively bulkier part anterior to the scleral spur may create more resistance to aqueous flow at the iridolenticular contact area, aggravating pupil block, anterior iris bowing, and angle crowding [14].

Mechanisms associated with suprachoroidal/uveal effusion

The volume and thickness of suprachoroidal space is supposed to be possibly regulated by the pressure within the choroid vessels, colloid osmotic pressure of the choroidal extracellular space, and IOP [15]. The pressure in the suprachoroidal space is 2 mm Hg lower relative to the pressure in the vitreous cavity [16]. This pressure difference produces a natural tendency for the choroid to expand inward [17-19].

Nowadays, laser peripheral iridotomy (LPI) has been proposed the standard prophylactic option for patients with PACS and a treatment option for PACG [20-22]. LPI also described as "laser iridotomy" or

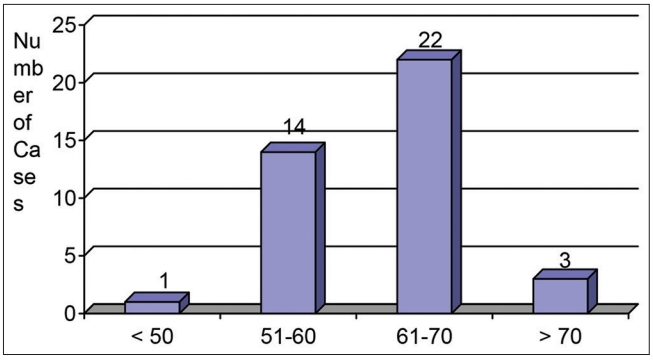


Fig. 1: Age distribution

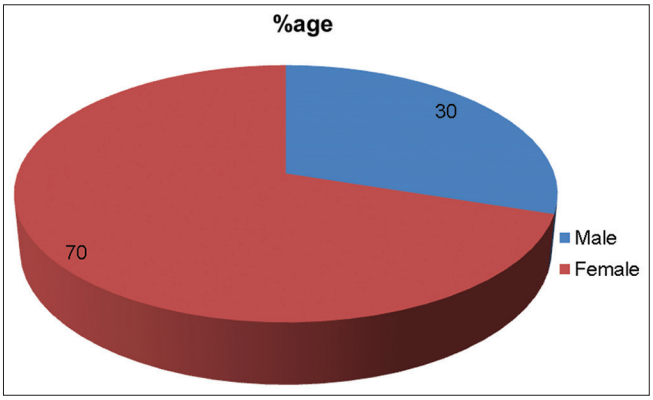


Fig. 2: Gender-wise distribution

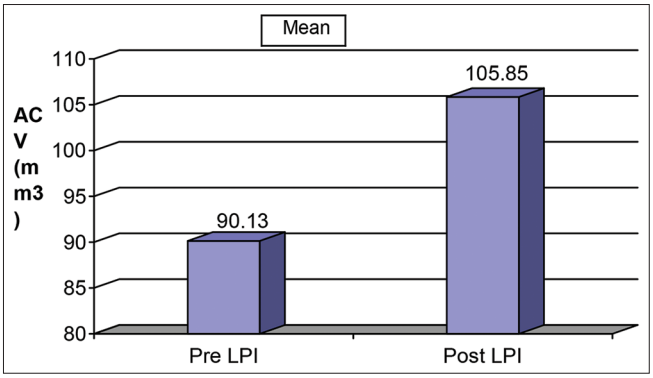


Fig. 3: Anterior chamber volume (ACV) before and 1 month after laser peripheral iridotomy (LPI)

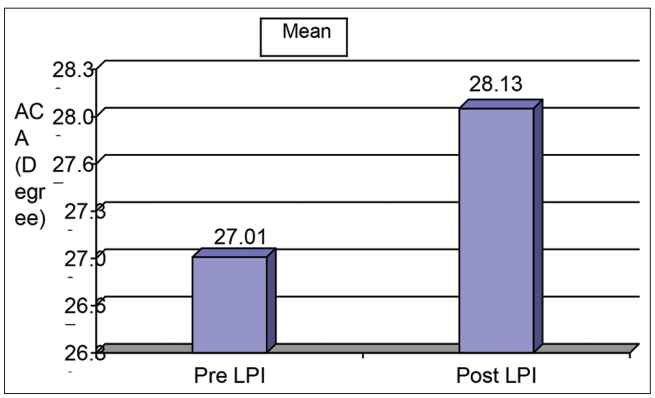


Fig. 4: Anterior chamber angle (ACA) before and 1 month after LPI

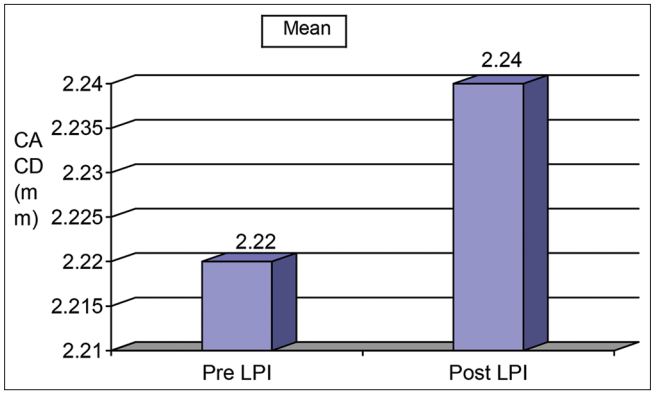


Fig. 5: Central anterior chamber depth (CACD) before and 1 month after LPI

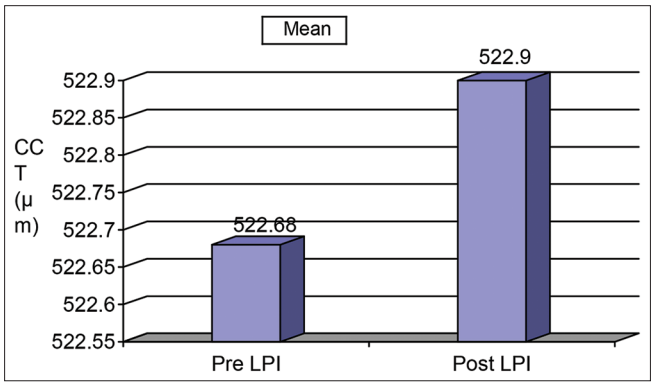


Fig. 6: CCT before and after 1 month of LPI

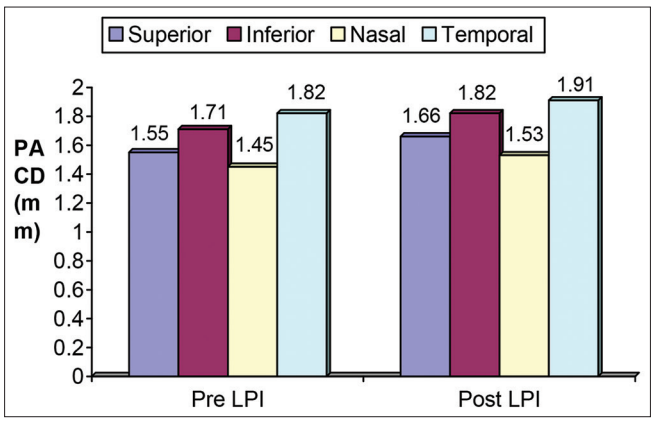


Fig. 7: Peripheral anterior chamber depth (PACD) AT 4 mm before and 1 month after LPI

simply termed "iridotomy" is a medical procedure which uses a laser device to create a hole in the iris, thereby allowing aqueous humor to traverse directly from the posterior to the anterior chamber and, consequently, relieve a pupillary block [23-25]. Complications of LPI include post-operative IOP spike, intraocular inflammation, iris bleeding and hyphema, focal cataract, posterior synechiae, and visual symptoms [26].

The Pentacam is comprised a rotating Scheimpflug camera that captures images of the anterior segment of the eye. Software allows evaluation and quantification of anterior segment parameters such as CACD, peripheral anterior chamber depth (PACD), anterior chamber volume (ACV), pupil diameter, and ACA of cross-section photographs

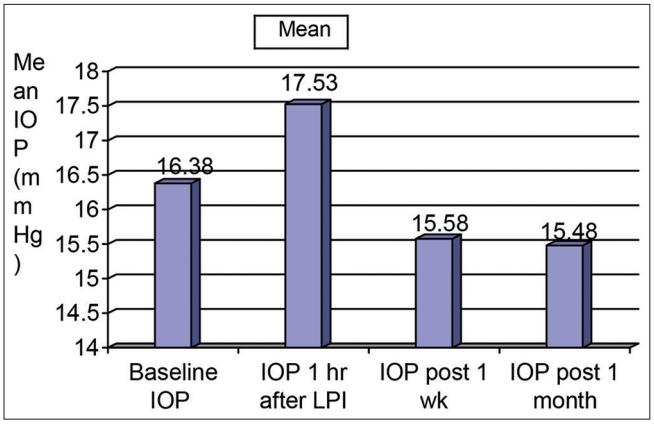


Fig. 8: IOP changes

Table 1: Age distribution

Age (in years)	No	%
<50	1	2.5
51–60	14	35
61–70	22	55
>70	3	7.5

Table 2: Gender distribution

Gender	No	% age
Male	12	30
Female	28	70
Total	40	100

Table 3: ACV before and 1 month after LPI

Parameter	Pre LPI		Post LPI		% changes	p-value
	Mean	SD	Mean	SD		
ACV (mm^3)	90.13	9.82	105.85	11.50	17.45	<0.0001

LPI: Laser peripheral iridotomy, ACV: Anterior chamber volume

from 0° to 360°. This non-contact procedure takes approximately 2 s [27]. Correction of image distortion plays an important role in all Scheimpflug application to corneal biometry, refractive surgery, anterior chamber biometry, and control of intraocular lens position stability [28].

METHODS

This was a prospective, non-randomized, and interventional study which was conducted on patients of PACS attending the Outpatient Department of Ophthalmology, Government Medical College, Patiala. The permission was taken from the Ethics Committee of Government Medical College, Patiala. Forty diagnosed patients with PACS fulfilling the inclusion criteria and having none of the exclusion criteria were enrolled in the study. Data for PACD, CACD, ACV, ACA, and central corneal thickness (CCT) was collected with Pentacam, data compiled and analyzed statistically.

Inclusion and exclusion criteria were as follows:

Inclusion criteria

The following criteria were included in the study:

1. Patients of Indian origin of either sexes with PACS which is defined as at least 270-degree iridotrabecular apposition without synechial changes, normal IOP, and normal optic disc features
2. Patients willing to follow-up and giving consent for study.

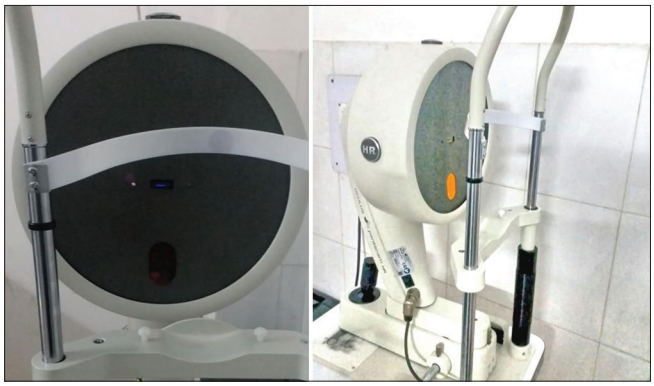
Exclusion criteria

The following criteria were excluded from the study:

1. Patients refusing for enrollment in the study
2. Patients with positive history (or objective signs) of ocular disorders other than PACS (glaucoma, uveitis, corneal ectatic disorder, and diabetic retinopathy)
3. Any abnormality preventing reliable applanation tonometry or examination of the fundus or anterior chamber
4. Progressive retinal/optic nerve damage other than glaucoma
5. Patients with history of any other form of glaucoma
6. Corneal dystrophy or degeneration
7. Any previous intraocular surgery
8. Patients with ocular hypertension
9. Ocular trauma
10. Keratoconus
11. Pterygium or corneal opacity
12. Patients with any previous laser treatments
13. Patients on topical or systemic anticholinergic or sympathomimetic agents.

The following examination was performed:

1. Visual acuity and refraction
2. Slit-lamp biomicroscopy
3. Ophthalmoscopic examination using 90D/78D lens
4. IOP by Goldmann applanation tonometry
5. Gonioscopy
6. Visual field testing
7. Pentacam.



Pentacam

Gonioscopy was performed on all the patients selected for the study. Gonioscopic grading of the angle was performed in a darkened room with minimum possible slit-lamp illumination with a 3-mirror lens on preliminary examination. The Shaffer system [29] was used to describe the angle between the trabecular meshwork and the iris as follows and PACS suspects were identified.

Shaffer system for grading angle widths:

Grade number	Angle width	Description	Risk of closure
4	45°–35°	Wide open	Impossible
3	35°–20°	Wide open	Impossible
2	20°	Narrow	Possible
1	<10°	Extremely narrow	Probable
Slit	Slit	Narrowed to slit	Probable
0	0°	Closed	Closed

LPI

Before performing LPI, the informed consent for LPI was obtained. The indications for the procedure, its benefits, and its complications were discussed in detail with the patient.

Pre-operative preparation

1. To reduce iris thickness and facilitate perforation, a drop of Pilocarpine 2–4% was instilled

2. For prevention of IOP spikes topical alpha 2 agonist 1 h before the procedure and immediately afterward was instilled.

Procedure

1. Topical anesthesia (Paracaine) was given
2. The patient was made to seat at the slit lamp and iris was examined under high magnification
3. Iridotomy site was chosen preferably in the superior quadrant in a thin looking area or an iris crypt of the iris which was well covered by the upper eyelid (to reduce visual symptoms)
4. LPI was performed using Abraham's iridotomy lens
5. Nd: YAG laser shots were delivered at the selected parameters, that is, 1–5 mJ power with 1–3 pulses per burst with a spot size of 50–70 μm (constant for each laser model)
6. Sudden gushing of the aqueous, iris pigments release from the iridotomy site was taken as the end point
7. Once a full-thickness hole was made, it was enlarged horizontally to achieve an adequate size
8. Bleeding if present was stopped by applying gentle pressure with the contact lens.

The following systemic and topical drugs were given post LPI:

1. Prednisolone acetate 1% eye drop, given 4 times a day for 5–7 days
2. Tab acetazolamide 250 mg BD ×5 days.

At 1 h after completion of LPI, the IOP was checked to make sure that it did not increase significantly.

After 1 week, the patients were examined to monitor IOP, to confirm the patency of the iridotomy site, and to check for any significant intraocular inflammation.

After 1 month of LPI, IOP was measured. Anterior chamber parameters, that is, CACD, PACD, CCT, and ACV were measured using the Pentacam and the findings were compiled and analyzed statistically.

Statistical analysis

All the statistical analysis was done using statistical software (SPSS version 19.0). The paired sample t-test was used to compare the difference in anterior segment parameter (Pentacam) before and after LPI. Wilcoxson signed-rank test was used to assess the PACD before and after LPI. $p<0.05$ was considered statistically significant.

RESULTS

In this prospective, non-randomized, and interventional study, 40 patients of PACSs were enrolled for analysis of ACA, anterior chamber (ACV), CCT, PACD, and CACD before and 1 month after LPI using Pentacam.

The mean age of patients in our study was 63±5.92 years. Age of most of the patients was in range of 50–70 years.

In our study, there were 70% females and 30% males.

The mean ACV was 90.13 mm^3 before LPI, after 1 month of LPI, the mean ACV was 105.50 mm^3 ($p<0.0001$) that shows significant increase in ACV. The percentage change was 17.45%.

Table 4 compares angle configuration before and 1 month after LPI. The baseline ACA was 27.01±3.23 degree, after 1 month of LPI ACA was 28.13±2.29 degree ($p<0.0001$) that showed the increase in ACA was statistically significant. The percentage change was 4.15%.

Mean CACD increased from 2.22±0.16 mm to 2.24±0.16 mm ($p=0.05$) and the result did not reach to the significant level.

The mean CCT was 522.68±31.46 before LPI, after 1 month of LPI CCT was 522.90±31.48 ($p=0.08$), the mean CCT was slightly thicker after LPI, but the changes were not significant.

Table 4: ACA before and after 1 month of LPI

Parameter	Pre LPI		Post LPI (1 month)		% changes	p-value
	Mean	SD	Mean	SD		
ACA (Degree)	27.01	3.23	28.13	2.29	4.15	<0.0001

ACA: Anterior chamber angle, LPI: Laser peripheral iridotomy

Table 5: CACD before and 1 month after LPI

Parameter	Pre-LPI		Post-LPI (1 month)		% changes	p value
	Mean	SD	Mean	SD		
CACD (mm)	2.22	0.16	2.24	0.16	0.76	0.05

CACD: Central anterior chamber depth, LPI: Laser peripheral iridotomy

Table 6: CCT before and 1 month after LPI

Parameter	Pre-LPI		Post-LPI (1 month)		%age changes	p value
	Mean	SD	Mean	SD		
CCT (μm)	522.68	31.46	522.90	31.48	0.04	0.08

CCT: Central corneal thickness, LPI: Laser peripheral iridotomy

Table 7: Anterior segment parameters recorded before and after 1 month of LPI

Parameters	Pre-laser iridotomy		Post-laser iridotomy		p-value (0.05 level)	% changes
	Mean	SD	Mean	SD		
ACV (mm^3)	90.13	9.82	105.85	11.50	<0.0001	17.45
ACA (degree)	27.01	3.23	28.13	2.96	<0.0001	4.15
CACD (mm)	2.22	0.16	2.24	0.16	0.05	0.76
CCT (μm)	522.68	31.46	522.90	31.48	0.08	4.15

CCT: Central corneal thickness, CACD: Central anterior chamber depth, ACV: Anterior chamber volume, ACA: Anterior chamber angle

Table 8: PACD at 4 mm before and 1 month after LPI

Parameters	Pre-LPI		Post-LPI		% changes	p-value (Wilcoxon)
	Mean	SD	Mean	SD		
Superior	1.55	0.17	1.66	0.16	6.34	<0.001
Inferior	1.71	0.19	1.82	0.19	6.62	<0.001
Nasal	1.45	0.17	1.53	0.17	5.45	<0.001
Temporal	1.82	0.16	1.91	0.19	4.52	<0.001

PACD: Peripheral anterior chamber depth, LPI: Laser peripheral iridotomy

Table 9: Intraocular pressure changes at 1 h, 1 week, and 1 month after LPI

Parameters	Mean	SD	p-value	Result
Baseline IOP (mmHg)	16.38	2.58		
IOP 1h after LPI	17.53	2.17	<0.001	S
IOP post 1 week	15.58	2.14	p=0.1	NS
IOP post 1 month	15.48	1.47	p=0.06	NS

IOP: Intraocular pressure, LPI: Laser peripheral iridotomy

After 1 month of LPI, the PACD-4 increased in all quadrants significantly. PACD measurement obtained from at 4 mm diameter circle at superior, inferior, nasal, and temporal quadrant.

IOP changes after LPI

The mean IOP before LPI was 16.38±2.58 mmHg, at 1 h post-LPI mean IOP was 17.53±2.17 mmHg ($p<0.001$), post procedure IOP elevation

was significant at 1 h. None of the eyes developed an IOP spike that is defined as 8 mm of Hg or greater elevation at 1h after LPI. In this study, rise in IOP was ≤5 mmHg compared to baseline. Eyes with shallow anterior chamber were at increased risk for IOP spike at 1 h after laser. In this study, all patients had received pre-operative brimonidine 0.15 and pilocarpine 2%.

At 1 week, post-LPI mean IOP was 15.58±2.14 mmHg (p=0.16) and after 1 month of LPI, the mean IOP was 15.48±1.47 mmHg (p=0.06) that the changes in IOP were not statistically significant at 1 week and 1 month post-LPI.

DISCUSSION

Glaucoma is leading cause of irreversible blindness. The main stay of treatment is early diagnosis and prevention of progression [1]. LPI is considered as the first line in the management of the patients with acute and chronic angle closure glaucoma [30]. This method has been also suggested as the preventive treatment option in eliminating the risk of recurrent acute attacks [31]. The mechanism of this intervention is allowing the aqueous to flow directly through the iridotomy site [32].

In the present study, our aim was to assess the anterior chamber parameters in PACS before and after LPI utilizing the pentacam.

In our study, we found significant changes in ACV, ACA, and PACD at 4 mm (PACD 4) after 1 month of LPI. However, the changes in CACD and CCT did not reach the significant level.

In the present study, mean age of patients was 63±5.92 years.

There were 28 female and 12 male as compared to the previous studies of Lee *et al*. [33] and Acet *et al*. [34], where the percentage of females was 83.33%, and 55%, respectively.

Population-based studies have consistently documented higher prevalence of PACG and PAC suspects among women and older persons [9,35,36]. It is generally believed that women are affected by PACG 3 times more often as men (2) the one possible reason for this difference is that the anterior chamber of the female eye is significantly narrower than that of male in normal subjects. Okabe *et al*. [37] studied 1169 eyes of participants in a glaucoma survey to clarify the relationship among angle width, age, and sex. He found that in all age groups, the angle width of women was significantly narrower than that of men.

ACV has been found to be a good screening tool for diagnosing eyes with narrow angles. Jain *et al*., in his study, found high sensitivity and specificity for ACV in eyes with narrow angles. With ACV of 110 mm^3 as cut off to define narrow angle, the Pentacam had a sensitivity and specificity of 88.37% and 90.62%, respectively. Positive predictive value of 92.7 and negative predictive value being 85.3. Any patient having ACV of <110 mm^3 had 9.42 times chance of having a narrow angle on gonioscopy.

(Likelihood ratio of having narrow angles=9.42) [38].

Oka *et al*. [39] reported that the ACV for the narrow angle group (74.5±21.1 mm^3) was significantly smaller than for the other groups (post LPI group: 96.4±21.4 mm^3; open angle: 144.2±31.6 mm^3, p<0.001). The most significant association was detected between ACV and the peripheral AC depth. Only two parameters, ACV and peripheral AC depth, increased significantly after LPI (p<0.001); thus, it can be concluded that the measurement of the AC volume and the peripheral AC depth using Pentacam is useful for evaluating the anterior ocular segment topography in narrow angle eyes.

Changes in ACV after LPI

In the present study, we found that ACV increased significantly in PACS after LPI from 90.13±9.82 mm^3 to 105.8±11.50 mm^3 (p<0.0001). This result is in agreement with study by Esmaeili *et al*., [40], where ACV changed from 85.97±16.07 mm^3 to 99.25±15.83 mm^3 after LPI. Talajic *et al.* [41] also concluded that after LPI ACV increased significantly in PACS from 94.6±3.6 mm^3 to 108.8±3.4 mm^3 (p=0.001).

Changes in ACA after LPI

In the present study, we found that mean ACA increased significantly from 27.01±3.23 degree to 28.13±2.29 degree (p<0.001). This was comparable with other studies conducted by Esmaeili *et al*., [40] Vryonis *et al*., [42] and Talajic *et al*. [41].

In study conducted by Esmaeili *et al*. [40], the mean ACA increased significantly from 25.59±4.41 degree to 26.46 ±4.33 degree after LPI. Vryonis *et al*. [42] also found widening in ACA from 21.1±4.8 to 23±3.8 degree (p=0.01) after LPI. In study conducted by Talajic *et al*. [41], ACA increased 26.7±0.9 degree to 28.2±0.08 degree (p<0.001).

LPI can eliminate the pupillary block component and may widen the ACA by equilibrating the pressure between the anterior and posterior chambers.

Changes in CCT after LPI

In our study, the CCT after LPI recorded slightly thicker than pre-LPI, but the changes in CCT were not statistically significant which is consistent with the previous study conducted by Esmaeili *et al*. [40] In the studies of Indian subjects by Ramani *et al*. and of Iranian individuals by Faramarzi *et al*., no significant changes in CCT were observed following LPI [43-45].

Changes in CACD after LPI

The results of the present study showed the statistically insignificant increase in CACD after the LPI. The previous studies reported inconsistent results for the changes in central ACD after the LPI [23-25]. Similarly, Li *et al*. [46] and Antoniazzi *et al*. [47] studies showed that the increase in ACD did not reach the significant level. Anterior chamber depth is measured by calculating the distance from the corneal endothelium to the anterior lens surface; the LPI moves the iris toward the posterior chamber which, however, has no effect on the lens position thus unlikely to affect CACD measurement.

Changes in PACD at 4 mm after LPI

In the present study, we measured PACD at 4 mm diameter circle with respect to corneal apex at 3, 9, 12, and 6 clocks hours; in this study, we found that PACD significantly increased in all four quadrants after LPI which is consistent with the previous studies.

PACD at 4 mm	Pre-LPI, mean	Post-LPI, mean	% Changes	p-value	Result
Inferior	1.53	1.74	6.62	<0.001	S
Superior	1.54	1.63	6.34	<0.001	S
Nasal	1.48	1.54	5.45	<0.001	S
Temporal	1.75	1.84	4.52	<0.001	S

PACD: Peripheral anterior chamber depth, LPI: Laser peripheral iridotomy

Li *et al*. [46], in study in PAC patients, found that after LPI PACD deepen significantly from 0.89±0.26 mm to1.14±0.26 mm in all 4 quadrants. The study conducted by No *et al*. [48] PACD at 4 mm and 8 mm circle showed significant deepening in all 4 quadrants with about 0.08 mm and 0.14 mm, respectively. Jain *et al*. [49] also concluded that immediately after LPI, the PACD-4 and PACD-8 increased in all quadrants significantly (p<0.001).

Changes in mean IOP after LPI

The mean IOP before LPI was 16.38±2.58 mmHg, at 1 h of LPI, mean IOP was 17.53±2.17 mmHg (p<0.001), and post-LPI IOP elevation was significant in our study. Few eyes developed higher IOP at 1 h and rise in IOP was ≤5 mmHg compared to baseline. However, none of the eyes developed a clinically significant IOP spike (≥8 mmHg) at 1 h after laser use.

In our study, all patient had received pre procedure brimonidine 0.15% and pilocarpine 2% along with oral acetazolamide 250 mg post-procedure; hence, the incidence of IOP spike (≥8 mmHg) after LPI was not there, as noted in the previous studies [50,51].

The previous studies have suggested that an IOP spike after LPI may be associated with both increased aqueous productions mediated by prostaglandin release and decreased outflow facility resulting from debris, denatured proteins, or cells. Higher amounts of laser energy may induce a stronger prostaglandin-mediated inflammatory response and thus cause more active aqueous production [52,53].

The mean IOP was 15.58±2.14 mmHg at 1 week (p=0.16) and 15.48±1.47 mmHg (p=0.06) at 1 month of LPI; there was no statistically significant difference in mean IOP at 1 week and 1-month follow-up visits compared to baseline.

The Scheimpflug imaging system can evaluate PACD and ACA non-invasively and easily and all parameters of the anterior ocular segment automatically and has high reliability. The advantage of this system is mechanical simplicity, quick, non-invasive, ease of handling, objectivity, and good quantitative measurement. This system may be useful for detecting eye with narrow angles and at risk for developing acute attack during regular eye checkup.

Limitations

1. This was a single center study with limited number of patients
2. Study was short term.

CONCLUSION

The present study was carried out in 40 patients of PACS fulfilling the inclusion criteria and having none of the exclusion criteria, visiting Department of Ophthalmology, Government Medical College, Patiala. Assessment of anterior chamber parameters was done with pentacam before LPI and after 1 month of LPI. The parameters studied were ACV, ACA, PACD, CCT, and CACD.

This was a prospective, non-randomized, and interventional single center study and we noted the followings:

1. Mean age was 63±5.92 years with more number of patients in the age group of 50–70 years.
2. There were 70% female and 30% male patients in the study.
3. Following LPI, ACV increased from 90.13± 9.82 mm^3 to 105.8±11.5 mm^3 after 1 month and this was statistically significant.
4. ACA increased from 27.01±3.23 degree to 28.13±2.29 after 1 month of LPI and this was also statistically significant.
5. PACD at 4 mm increased significantly in superior, inferior, nasal, and temporal quadrant in all cases.
6. However, CCT and CACD did not show statistically significant changes after 1 month of LPI.

LPI causes improvement in anterior chamber parameters by means of ACV, ACA, and PACD. Furthermore, Pentacam is a useful tool to assess these parameters before and after LPI.

AUTHORS' CONTRIBUTIONS

MN and RS contributed in identifying and management of PACS. MN and RS also contributed in identifying the patients who met the criteria for LPI. MN and RS contributed in post laser iridotomy care. JT, HK, and SK contributed in statistics. MN, RS, SK, JT, HK, SM, and PK drafted the manuscript. MN, RS, SK, JT, HK, SM, and PK revised the manuscript. All authors read and approved the final manuscript.

CONFLICTS OF INTEREST

We declare that we have no conflicts of interest.

FUNDING AND SPONSORSHIP

Not Applicable.

REFERENCES

1. Allingham RR, Damji KF, Freedman S, Moroi SE, Rhee DJ.
2. Quigley HA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020. Br J Ophthalmol 2006;90:262-7. doi: 10.1136/bjo.2005.081224, PMID 16488940
3. Foster PJ, Buhrmann R, Quigley HA, Johnson GJ. The definition and classification of glaucoma in prevalence surveys. Br J Ophthalmol 2002;86:238-42. doi: 10.1136/bjo.86.2.238, PMID 11815354
4. Stamper RL, Lieberman MF, Drake MV. Becker Shaffer's Diagnosis and Therapy of the Glaucomas. 8th ed. United States: Mosby; 2009.
5. Wojciechowski R, Congdon N, Anninger W, Teo Broman A. Age, gender, biometry, refractive error, and the anterior chamber angle among Alaskan Eskimos. Ophthalmology 2003;110:365-75. doi: 10.1016/S0161-6420(02)01748-7, PMID 12578783
6. Sherpa D, Badhu BP. Association between axial length of the eye and primary angle closure glaucoma. Kathmandu Univ Med J (KUMJ) 2008;6:361-3. doi: 10.3126/kumj.v6i3.1712
7. Qi Y. Ultrasonic evaluation of the lens thickness to axial length factor in primary closure angle glaucoma. Yan Ke Xue Bao 1993;9:12-4. PMID 8253175
8. Marchini G. Biometric data and pathogenesis of angle closure glaucoma. Acta Ophthalmol Scand Suppl 2002;236:13-4. doi: 10.1034/j.1600-0420.80.s236.3.x, PMID 12390109
9. George R, Paul PG, Baskaran M, Ramesh SV, Raju P, Arvind H, *et al*. Ocular biometry in occludable angles and angle closure glaucoma: A population-based survey. Br J Ophthalmol 2003;87:399-402. doi: 10.1136/bjo.87.4.399, PMID 12642298
10. Tiedeman JS. A physical analysis of the factors that determine the contour of the iris. Am J Ophthalmol 1991;111:338-43. doi: 10.1016/s0002-9394(14)72319-0, PMID 2000904
11. Pavlin CJ, Ritch R, Foster FS. Ultrasound biomicroscopy in plateau iris syndrome. Am J Ophthalmol 1992;113:390-5. doi: 10.1016/s0002-9394(14)76160-4, PMID 1558112
12. Quigley HA. What's the choroid got to do with angle closure? Arch Ophthalmol 2009;127:693-4. doi: 10.1001/archophthalmol.2009.80, PMID 19433722
13. Aung T, Chew PT. Review of recent advancements in the understanding of primary angle-closure glaucoma. Curr Opin Ophthalmol 2002;13:89-93. doi: 10.1097/00055735-200204000-00006, PMID 11880721
14. Tarongoy P, Ho CL, Walton DS. Angle-closure glaucoma: The role of the lens in the pathogenesis, prevention, and treatment. Surv Ophthalmol 2009;54:211-25. doi: 10.1016/j.survophthal.2008.12.002, PMID 19298900
15. Quigley HA, Friedman DS, Congdon NG. Possible mechanisms of primary angle-closure and malignant glaucoma. J Glaucoma 2003;12:167-80. doi: 10.1097/00061198-200304000-00013, PMID 12671473
16. Brubaker RF, Pederson JE. Ciliochoroidal detachment. Surv Ophthalmol 1983;27:281-9. doi: 10.1016/0039-6257(83)90228-x, PMID 6407132
17. Hung LF, Wallman J, Smith EL 3rd. Vision-dependent changes in the choroidal thickness of macaque monkeys. Invest Ophthalmol Vis Sci 2000;41:1259-69. PMID 10798639
18. Papastergiou GI, Schmid GF, Riva CE, Mendel MJ, Stone RA, Laties AM. Ocular axial length and choroidal thickness in newly hatched chicks and one-year-old chickens fluctuate in a diurnal pattern that is influenced by visual experience and intraocular pressure changes. Exp Eye Res 1998;66:195-205. doi: 10.1006/exer.1997.0421, PMID 9533845
19. Schuman JS, Massicotte EC, Connolly S, Hertzmark E, Mukherji B, Kunen MZ. Increased intraocular pressure and visual field defects in high resistance wind instrument players. Ophthalmology 2000;107:127-33. doi: 10.1016/s0161-6420(99)00015-9, PMID 10647731
20. Snow JT. Value of prophylactic peripheral iridectomy on the second eye in angle-closure glaucoma. Trans Ophthalmol Soc U K (1962) 1977;97:189-91. PMID 271393
21. Edwards RS. Behaviour of the fellow eye in acute angle-closure glaucoma. Br J Ophthalmol 1982;66:576-9. doi: 10.1136/bjo.66.9.576
22. Lowe RF. Persistent symptoms after peripheral iridectomy for angle-closure glaucoma. Aust N Z J Ophthalmol 1987;15:83-7.
23. European glaucoma society terminology and guidelines for glaucoma, 4th edition-chapter 3: Treatment principles and options supported by the EGS foundation: Part 1: Foreword; Introduction; Glossary; Chapter 3 treatment principles and options. Br J Ophthalmol 2017;101:130-95.
24. Prum BE Jr., Herndon LW Jr., Moroi SE, Mansberger SL, Stein JD, Lim MC, *et al*. Primary angle closure preferred practice pattern (®) guidelines. Ophthalmology 2016;123:P1-40.

25. Lam DS, Tham CC, Congdon NG, Baig N. Peripheral Iridotomy for Angle-Closure Glaucoma. Glaucoma. Amsterdam: Elsevier; 2015. p. 708-15.
26. Radhakrishnan S, Chen PP, Junk AK, Nouri-Mahdavi K, Chen TC. Laser peripheral iridotomy in primary angle closure: A report by the American academy of Ophthalmology. Ophthalmology 2018;125:1110-20. doi: 10.1016/j.ophtha.2018.01.015, PMID 29482864
27. Jain R, Grewal D, Grewal SP. Quantitative analysis of anterior chamber following peripheral laser iridotomy using Pentacam in eyes with primary angle closure. Eur J Ophthalmol 2013;23:55-60.
28. Jain R, Dilraj G, Grewal SP. Repeatability of corneal parameters with Pentacam after laser in situ keratomileusis. Indian J Ophthalmol 2007;55:341-47. doi: 10.4103/0301-4738.33819, PMID 17699942
29. Shaffer RN. Primary glaucomas. Gonioscopy, ophthalmoscopy and perimetry. Trans Am Acad Ophthalmol Otolaryngol 1960;64:112-27.
30. Lowe RF. Persistent symptoms after peripheral iridectomy for angle-closure glaucoma. Aust N Z J Ophthalmol 1987;15:83-7. doi: 10.1111/j.1442-9071.1987.tb00309.x, PMID 3593567
31. Gazzard G, Friedman DS, Devereux JG, Chew P, Seah SK. A prospective ultrasound biomicroscopy evaluation of changes in anterior segment morphology after laser iridotomy in Asian eyes. Ophthalmology 2003;110:630-8. doi: 10.1016/S0161-6420(02)01893-6, PMID 12623834
32. Lackner B, Schmidinger G, Skorpik C. Validity and repeatability of anterior chamber depth measurements with Pentacam and Orbscan. Optom Vis Sci 2005;82:858-61. doi: 10.1097/01.opx.0000177804.53192.15, PMID 16189497
33. Lee JR, Choi JY, Kim YD, Choi J. Laser peripheral iridotomy with Iridoplasty in primary angle closure suspect: Anterior chamber analysis by Pentacam. Korean J Ophthalmol 2011;25:252-6. doi: 10.3341/kjo.2011.25.4.252, PMID 21860572
34. Acet Y, Yigit FU, Onur IU, Agachan A, Tugcu B, Orum O. The course of the changes in anterior chamber parameters after laser peripheral iridotomy: Follow up for 6 months with a Scheimpug-Placido disc topographer. J Glaucoma 2016;25:14-21.
35. Foster PJ, Baasanhu J, Alsbirk PH, Munkhbayar D, Uranchimeg D, Johnson GJ. Glaucoma in Mongolia. A population-based survey in Hovsgol Province, Northern Mongolia. Arch Ophthalmol 1996;114:1235-41. doi: 10.1001/archopht.1996.01100140435011, PMID 8859083
36. Arkell SM, Lightman DA, Sommer A, Taylor HR, Korshin OM, Tielsch JM. The prevalence of glaucoma among Eskimos of Northwest Alaska. Arch Ophthalmol 1987;105:482-5. doi: 10.1001/archopht.1987.01060040052031, PMID 3566600
37. Okabe I, Tomita G, Sugiyama K, Taniguchi T. An epidemiological study on the prevalence of the narrow chamber angle in Japanese. Nippon Ganka Gakkai Zasshi 1991;95:279-87. PMID 1872206
38. Jain R, Grewal D, Grewal SP. Pentacam Evaluation of Changes in Anterior Chamber Depth and Volume in Cases with Primary Angle Closure after Instillation of Pilocarpine. Presented at: The XXIV Annual Congress of ESCRS; 2006. Vol. 9-13. London, United Kingdom.
39. Oka N, Otori Y, Okada M, Miki A, Maeda N, Tano Y. Clinical study of anterior ocular segment topography in angle-closure glaucoma using the three-dimensional anterior segment analyser Pentacam. Nippon Ganka Gakkai Zasshi 2006;110:398-403. PMID 16764322
40. Esmaeili A, Barazandeh B, Ahmadi S, Haghi A, Hosseini SM, Abolbashari F. Assessment of the anterior chamber parameters after laser iridotomy in primary angle closer suspect using Pentacamand Gonioscopy. Int J Ophthalmol 2013;6:680-4.
41. Talajic JC, Lesk MR, Nantel-Battista M, Harasymowycz PJ. Anterior segment changes after pilocarpine and laser iridotomy for primary angle-closure suspects with Scheimpflug photography. J Glaucoma 2013;22:776-9. doi: 10.1097/IJG.0b013e318259505a, PMID 22668977
42. Vryonis N, Nikita E, Vergados I, Theodossiadis P, Filippopoulos T. Anterior chamber morphology before and after laser peripheral iridotomy determined by Scheimpflug technology in white patients with narrow angles. J Glaucoma 2013;22:679-83. doi: 10.1097/IJG.0b013e318264b908, PMID 22828006
43. Schwenn O, Sell F, Pfeiffer N, Grehn F. Prophylactic Nd: YAG-laser iridotomy versus surgical iridectomy: A randomized, prospective study. Ger J Ophthalmol 1995;4:374-9. PMID 8751104
44. Ramani KK, Mani B, George RJ, Lingam V. Follow-up of primary angle closure suspects after laser peripheral iridotomy using ultrasound biomicroscopy and A-scan biometry for a period of 2 years. J Glaucoma 2009;18:521-7. doi: 10.1097/IJG.0b013e318193c12d, PMID 19745666
45. Faramarzi A, Yazdani S, Pakravan M. Central anterior chamber depth changes after prophylactic laser iridotomy. Optom Vis Sci 2013;90:707-10. doi: 10.1097/OPX.0b013e3182968c62, PMID 23748845
46. Li S, Wang H, Mu D, Fu J, Wang X, Wang J, *et al*. Prospective evaluation of changes in anterior segment morphology after laser iridotomy in Chinese eyes by rotating Scheimpflug camera imaging. Clin Exp Ophthalmol 2010;38:10-4. doi: 10.1111/j.1442-9071.2010.02205.x. PMID 20447095
47. Antoniazzi E, Pezzotta S, Delfino A, Bianchi PE. Anterior chamber measurements taken with Pentacam: An objective tool in laser iridotomy. Eur J Ophthalmol 2010;20:517-22. doi: 10.1177/112067211002000325, PMID 20037901
48. Aboleila A, El-Sharkawy H, Abd El Ghafar AA, Ghanem AA. Evaluation of anterior segment changes following laser peripheral iridotomy by Scheimpflug imaging. ARC J Ophthalmol 2018;3:13-6.
49. Jain R, Grewal D, Grewal SP. Quantitative analysis of anterior chamber following peripheral laser iridotomy using Pentacam in eyes with primary angle closure. Eur J Ophthalmol 2012;. doi: 10.5301/ejo.5000158, PMID 22610719
50. Yuen NS, Cheung P, Hui SP. Comparing brimonidine 0.2% to Apraclonidine 1.0% in the prevention of intraocular pressure elevation and their pupillary effects following laser peripheral iridotomy. Jpn J Ophthalmol 2005;49:89-92. doi: 10.1007/s10384-004-0149-9, PMID 15838723
51. Shani L, David R, Tessler Z, Rosen S, Schneck M, Yassur Y. Intraocular pressure after neodymium: YAG laser treatments in the anterior segment. J Cataract Refract Surg 1994;20:455-8. doi: 10.1016/s0886-3350(13)80184-8, PMID 7932138
52. Robin AL, Pollack IP. A comparison of neodymium: YAG and argon laser iridotomies. Ophthalmology 1984;91:1011-6. doi: 10.1016/s0161-6420(84)34199-9, PMID 6387569
53. Schrems W, Eichelbrönner O, Krieglstein GK. The immediate IOP response of Nd-YAG-laser iridotomy and its prophylactic treatability. Acta Ophthalmol (Copenh) 1984;62:673-80. doi: 10.1111/j.1755-3768.1984.tb05794.x, PMID 6548856