Evaluation of changes in IOP and anterior chamber parameters post laser irodotomy using pentacam system

Monika Kharbanda[1], Ishwar Singh[2,*], Sachin Walia[3], Harsimran Singh[4]

[1]Senior Resident, [2,4]Assistant Professor, [3]Professor & Head, Dept. of Ophthalmology, Govt. Medical College, Patiala

***Corresponding Author:**
Email: issaini2000@yahoo.in

Abstract

Introduction: Aim of the study was to evaluate IOP changes and anterior chamber parameters (depth and volume), in primary angle closure (PAC) cases after laser peripheral irodotomy (LPI) using Pentacam system in OPD patients at Govt. Medical College, Patiala.

Material and Methods: Total 12 eyes of 12 PAC patients were analysed in the study in the period of 3 months from March 2017 to May 2017. LPI was performed on the enrolled eyes, Pentacam system was used to calculate anterior chamber and IOP changes pre and post 14 days of LPI treatment.

Results: There was statistically significant difference before LPI and after LPI for all measured variables. The mean ACD and ACV increased by p=0.04 and p = 0.001 respectively in 12 patients. The mean IOP decreased in all eyes with p=0.03 at month 3 and thereafter.

Conclusion: In conclusion, LPI produces significant anterior chamber depth & volume along with decrease in IOP making LPI effective in treatment of primary angle closure cases.

Keywords: IOP, Pentacam, LPI, Primary Angle closure.

Introduction

Primary angle closure glaucoma (PACG) is an important cause of ocular morbidity and blindness. PACG will account for approximately 5.3 million people blind by 2020.(1) In PACG, iridotrabecular apposition or synechiae formation obstructs aqueous outflow leading to increase in intra ocular pressure (IOP). Laser peripherial iridotomy (LPI) is a proven method to treat acute and chronic PACG.(2) In this procedure a hole is made in the periphery of iris allowing aqueous to drain from posterior chamber to anterior chamber(3) LPI widens the configuration of anterior chamber angle, resolves the papillary block and helps to decrease aqueous pressure. LPI is a safe procedure with low morbidity and appears to have role in preventing progression of PAC into PACG.(4)

Evaluation of the anterior segment parameters as anterior chamber depth (ACD), anterior chamber volume (ACV), central corneal thickness (CCT) is an important part of ophthalmic examination in patients with PAC. Many novel techniques are continuously emerging to provide quantitative information and qualitative imaging of anterior segment structures. Out of these, Pentacam is a non-contact device to analyse different parameters of anterior segment of the eye with high patient comfort. It uses two cameras and measures anterior chamber quantitatively in short period and does not require topical anesthesia. Moreover, Pentacam software allows IOP modifications based on the central corneal thickness and gives corrected IOP measurement in patients with glaucoma. Therefore in this study, we aimed to evaluate quantitative alterations in anterior chamber parameters and IOP after LPI in PAC patient using pentacam system.

Materials and Methods

The current prospective study was conducted in the department of Ophthalmology, Rajindra Hospital, Patiala. 12 patients were enrolled in the study. The written consent was obtained from all the patients after explanation of the study protocol. Patients included in the study had occludable angle with TBM not visible for > 270° or having peripheral anterior synechiae, IOP $\geq$ 21 mmHg. The visual field and the optic disc appearance were normal. We excluded the eyes having corneal disorders (keratoconus, Pterygium or opacity), if any history of previous surgery or trauma, acute attack of glaucoma, ocular infection or patients unable to attend follow-up.

Slit lamp biomicroscopy of anterior segment, gonioscopy with zeiss 4 mirror lens, ophthalmoscopy, IOP measurement and visual field testing was done on the selected eyes of the patients enrolled in this study. The patient was seated comfortably on chin rest of Pentacam and the imaging was performed by trained ophthalmologist. All measurements were performed under standard dim light condition with undilated pupils, with patient fixating on the fixation light during the entire process. Correct alignment of beam is important because minor deviation affects the result of anterior chamber depth measurement. The rotating scheimpflug camera captured images and after images were stored, quantitative analysis of anterior chamber was done: anterior chamber depth along the optical axis (ACDmm), anterior chamber volume (ACVmm^3), modified IOP (mm Hg) were measured with the aid of specialized inbuilt programme.

After instillation of 1% pilocarpin drops, all patients received Nd: YAG LPI using anterior segment YAG

contact lens between 10 to 2 o'clock of these eyes. LPI was performed in each patient with the settings. Nd YAG 5-8 mJoule, 1-5 shots. Post irodotomy, patients were given 0.1% dexamethasone and moxifloxacin eye drop 4 times/day, 0.5% timolol eye drops 2 times / day for 3 days. After 14 days of treatment, all the enrolled eyes were examined and analysed by the same ophthalmologist. Observations thus made were recorded and subjected to statistical anlaysis at the end of study using paired T-test. The statistical significant level was set at $p \leq 0.05$.

Results

A total of 12 eyes (8 female and 4 males) with mean age of 59.1 ± 8.3 were included in the study, 6 had occludable angle with TBM not visible for more than 270° and 6 had peripheral anterior synichae. After 14 days of LPI, anterior chamber depth increased from 1.65 ± 0.54 to 1.98 ± 0.82 with p value = 0.04. The mean anterior chamber volume increased from 78.52 ± 12.40 to 96.14 ± 15.49 with p value = 0.001. The mean IOP significantly decreased after LPI from 21.85 ± 3.0 to 19.97 ± 2.8 with p value = 0.03. None of the patients in our study reported spike in IOP, bleeding at laser site or inflammation during the study protocol in the treated eye.

Discussion

The detection and monitoring of glaucoma traditionally involves measurement of IOP, evaluation of optic nerve head and visual field testing. But PACG is a multifactorial optic neuropathy which included spectrum of diseases and subtypes. It may present with acute symptoms or run a chronic course. LPI is the first line intervention and effective therapy for PAC. It prevents the development of PAC into PACG.[5] We need accurate and quantitative method for follow-up of patients in PAC to confirm the effects of LPI.

There is an emerging trend for rapid and reliable techniques as UBM (Ultrabiomicroscope), ASOCT (Anterior segment Optical coherence tomography), A scan, scanning scheimpflug camera, scanning slit lamp systems and SPAC (Scanning Peripheral Anterior Chamber Depth Analyzer).[6] To produce real time images of anterior segment structures involved in glaucoma. Among these, Pentacam seems to be promising technology providing rapid and reproducible measurements of anterior chamber with its rotating scheimpflug camera. The rotating camera takes images from numerous data points in 2 seconds after 180° rotation. The internal software gives three dimensional reconstruction of the anterior segment, information, three dimensional images of the anterior segment of eye and quantify anterior chamber depth & anterior chamber volume using colored map. Accurate measurement of CCT (Central Corneal Thickness) has significance in evaluation of glaucoma patients.[7] Pentacam measures corneal thickness from central 8-10mm of the cornea using rotational slit - scanning principles and gives corrected IOP measurement.[8] Therefore, we used the technology of Pentacam for the evaluation of AC parameters & IOP post laser iridotomy in PAC patients.

The results of the present study showed that LPI had significant effects on various parameters of anterior chamber in PAC patients. Most of the previous studies reported good results with no side-effects. A decrease in IOP has been reported in many previous studies in patients with PAC upto months after laser treatment. Mc Galliard et al (1990) reported that in eyes with well-established PAS 69% showed a drop in IOP after LPI in eyes with shallow AC.[4] Iridotomy will prevent further development of synechial closure and reduce the risk of an acute angle glaucoma. Similarly Lee et al (2009) reported that the mean IOP was 17.8± 3.3 and 15.9 ± 3.1 mm Hg before and after LPI, respectively, p=0.042 in his study. There was reduction in IOP by 1.9mm Hg due to reopening of angles that were appositionally closed before LPI.[9] Lopez Caballero et al (2010) reported mean change in IOP from 20.8 mm Hg to 18.3 mm Hg after LPI ($p<0.05$) in study of 20 eyes of 20 patients with PACG using Pentacam imaging system.[10] Similarly, we also found a significant reduction in the mean IOP values in our study after LPI ($p = 0.03$).

The anterior chamber volume was calculated using specialized software inbuilt in the device, the mean anterior chamber volume increased from 78.52 ± 12.40 to 96.14 ± 15.49 after LPI, and this was in accordance with the previous studies. Esmaeili et al investigated change in ACV from 85.97± 16.07 mm^3 to 99.25 ± 15.83mm^3 (p=0.000) in 48 eyes of PACS patients.[11] Similarly Acet et al (2014) analyzed 109 eyes of 56 patients in 6 months trial and showed that ACV increased from 1.00µl to 2.25µl, p=0.03 after LPI procedure.[12]

In our study, we have determined a statistically significant increase in anterior chamber depth on 14 day follow-up. LPI helps to relieve the relative pupillary block in eyes with shallow AC and helps to deepen ACD. Oka et al (2006) showed that peripheral ACD increased in study of angle closure glaucoma patients after LPI procedure.[13] Our results are in accordance to Lopez Callbero (2010) who evaluated changes in AC morphology after LPI and reported ACD increase significantly from 1.79mm (SD 0.22) to 1.85mm, (SD 0.21) in his patients.[10]

Although anterior chamber angle widening occurs after LPI and is reported in the literature. But in our study, we did not evaluate ACA as Pentacam does not allow angle recess assessment in detail. There is total internal reflection and light scattering occurs at ACA region. The rotating camera cannot penetrate the corneoscleral limbus and iridocorneal structures are not visible clearly which might increase the risk of errors.

Table 1: Observation and Results

	Pre (Mean±SD)	Post (Mean±SD)	P value
IOP (mmHg)	21.85±3.0	19.97±2.8	0.03
ACD (mm)	1.65±0.54	1.98±0.82	0.04
ACV (mm^3)	78.52±12.40	96.14±15.49	0.001

IOP - Intra ocular pressure measured in mmHg, ACD - Anterior chamber depth measured in mm and ACV - Anterior chamber volume measured in mm^3

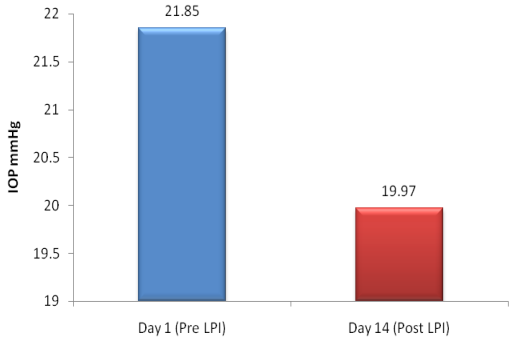

Fig. 1: Comparative analysis of IOP intra ocular pressure in mmHg pre and post LPI

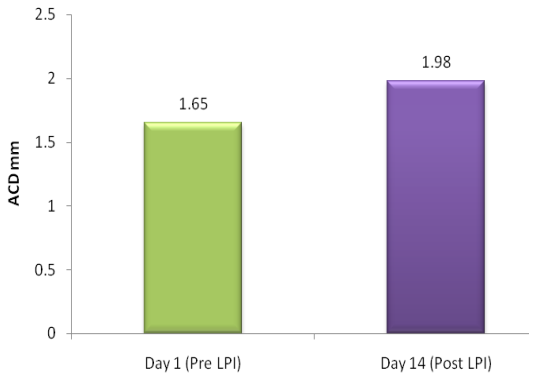

Fig. 2: Comparative analysis of anterior chamber depth in mm pre and post LPI

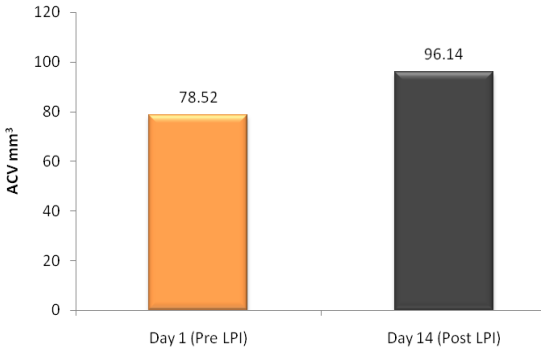

Fig. 3: Comparative analysis of anterior chamber volume in mm^3 pre and post LPI

Conclusion

In summary, this study establishes that LPI is the definitive treatment of choice for PAC. It decreased IOP in all patients with concomitant increase in anterior chamber parameters. These changes can be demonstrated by Pentacam objectively and quantitatively. Hence, application of pentacam system can prove to be essential tool for follow up and assessment of PAC patients.

However, the success of clinical approach would be further advanced by conducting study on larger population. Also the study should be conducted on the various sub-types of disease for the better understanding of the factors that determined the course of disease and its outcome. There are no conflicts of interest.

Reference

1. Quigley HA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020. Br. J Ophthalmol 2006;90:262-7
2. Hsiao CH, Hsu CT, Shen SC, Chen HS. Mid-term follow-up of Nd: YAG laser iridotomy in Asian eyes. Ophthalmic Surg Laser Imaging 2003;34:291–298.
3. Jin JC, Anderson DR. The effect of iridotomy on iris contour. Am J Ophthalmol 1990;110:260–263.
4. McGalliard JN, Wishart PK. The effect of Nd: YAG iridotomy on intraocular pressure in hypertensive eyes with shallow anterior chambers. Eye 1990;4:823–829.
5. Nolan WP, Foster PJ, Devereux JG, Uranchimeg D, Johnson GJ, Baasanhu J. YAG laser iridotomy treatment for primary angle closure in east Asian eyes. Br J Ophthalmol 2000;84:1255–1259.
6. Rabsilber TM, Khoramnia R, Auffarth GU. Anterior Chamber measurements using Pentacam rotating Scheimpflug camera. J Cataract Refract Surg 2006;32:456-459.
7. Herndon LW, Weizer JS, Stinnett SS. CCT as risk factor for advanced glaucoma damage. Arch Ophthalmol 2004;122:17–21.
8. Yazici AT, Bozkurt E, Alagoz C, Pekel G, Kaya V, Yilmaz OF. CCT, anterior chamber depth, and pupil diameter measurements using Visante OCT, Orbscan and Pentacam. J Cataract Refract Surg 2010;26:12,6–137.
9. 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;25:252-256.
10. Lopez-Caballero C, Puerto-Hernandez B, Munoz-Negrete FJ, et al. Quantitative evaluation of anterior chamber changes after iridotomy using Pentacam anterior segment analyzer. Eur J Ophthalmol. 2010;20:327-332.
11. Esmaeili A, Barazandeh B, Ahmadi S, Haghi A, Ahmadi Hosseini SM, Abolbashari F. Assessment of the anterior chamber parameters after laser iridotomy in primary angle close suspect using Pentacam and gonioscopy. Int J Ophthalmol. 2013;6:680-684.
12. 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 Scheimpflug-Placido disc topographer. J Glaucoma. 2014.
13. Oka N, Otori Y, Okada M, Miki A, Maeda N, Tano Y. Clinical study of anterior ocular segment tomography in angle closure glaucoma using three dimensional anterior segment analyzer pentacam. Nihon Ganka Gakkai Zaashi 2006;110:398-403.