A Prospective, Comparative, Randomized Study Evaluating Anterior Chamber Parameters in Angle Closure Glaucoma Spectrum with Normal Individuals with Scheimpflug Imaging

Tripti Thakur[1], Amar Kumar[2]

[1]Senior Resident, Department of Ophthalmology, IGIMS, Patna, Bihar, India

[2]Senior Resident, Department of Ophthalmology, IGIMS, Patna, Bihar, India

Abstract

Aim: The aim of the present study was to compare anterior chamber parameters in angle closure glaucoma spectrum with normal individuals with Scheimpflug imaging.

Methods: The Present study was prospective, comparative, randomized study, carried out in the Department of Ophthalmology, IGIMS, Patna, Bihar, India. Study duration was of 1 year. In present study sample size was 40 eyes in each group.

Results: In present study patients were from age group between 51 - 60 years in both the groups i.e. 18 in group A (Angle closure glaucoma spectrum eyes) and 20 in group B (eyes of normal individual) followed by 40 - 50 years 14 in group A and 16 in group B. 40% were male and 60% were females. In present study primary angle closure suspects eyes were most common (60%), followed by PACG (20%) and primary angle closure (15%). In present study anterior chamber parameters in both the groups were more in group B (eyes of normal individual) than in group A (Angle closure glaucoma spectrum eyes). Also ACV/AL, ACV/KERATOMETRY, ACV/WTW, ACV/LT were more in group B(eyes of normal individual) than group A(Angle closure glaucoma spectrum eyes) and this difference was statistically significant. All anterior chamber parameters were more in PAC eyes than in PACS eyes and this difference was statistically significant in all parameters (p value <0.05) except in ACV/AL and in ACV/WTW.

Conclusion: In present study all anterior chamber parameters were more in normal eyes compared to angle closure glaucoma spectrum and mean difference was significant. Scheimpflug imaging can be a very useful tool in differentiating angle closure glaucoma spectrum from normal individuals, but, it cannot differentiate between the patients within the spectrum like primary angle closure suspect versus primary angle closure versus primary angle closure glaucoma.

Keywords: anterior chamber parameters, angle closure glaucoma, Scheimpflug imaging, gonioscopy

Introduction

Glaucoma affects approximately 67 million people making it the most common cause of irreversible blindness worldwide. [1] Although constituting only about 26% of all glaucoma, primary angle closure glaucoma (PACG) is an aggressive and visually destructive disease, [2,3] with estimations that it blinds five times more people than primary open-angle glaucoma [4] making it an important public health problem. The prevalence of PACG varies among different ethnic groups and is a major form of glaucoma in the populous nations of China [5] and India. [6] To effectively prevent PACG by the use of prophylactic laser iridotomy, it is necessary to identify people with anatomically narrow angles.

Recently recommended classifications for angle closure (glaucoma) based on gonioscopy and clinical examination consist of: primary angle closure suspect (PACS) characterized by iridotrabecular contact exceeding 180˚ [7,8] or 270˚ [9] but otherwise normal findings; primary angle closure (PAC) is defined in the presence of PACS characteristics plus peripheral anterior synechiae (PAS) formation, high intraocular pressure (IOP), or iris/lens changes suggestive of a previous attack of angle closure in the absence of signs of optic disc damage or visual field defects; primary angle closure glaucoma (PACG) is defined as the above mentioned characteristics together with evidence of end organ damage such as glaucomatous optic disc changes and/or visual field defects. [9]

Another classification is based on angle appearance and presentation of the disease which is categorized

as acute, subacute or chronic angle closure glaucoma. [10] While the acute, symptomatic phase is dramatic, it occurs only in a minority of patients with PACG and the chronic, asymptomatic form of the disease predominates. Recent advances in anterior segment imaging have improved the ability to evaluate and measure anterior segment parameters in an objective and repeatable way, and have resulted in a better understanding of the pathophysiology of primary angle closure disease and diagnosis of secondary types of angle closure glaucoma. [11] Pentacam imaging is a noninvasive noncontact method which uses a single rotating Scheimpflug camera for anterior segment imaging in a quantitative and reproducible way. [11,12] Anterior segment imaging modalities such as Pentacam may help define and detect high risk eyes.

The aim of the present study was to compare anterior chamber parameters in angle closure glaucoma spectrum with normal individuals with Scheimpflug imaging.

Materials and Methods

The Present study was prospective, comparative, randomized study, carried out in the Department of Ophthalmology, IGIMS, Patna, Bihar, India. Study duration was of 1 year. In present study sample size was 40 eyes in each group.

Inclusion criteria:

• Glaucoma suspect

• In patients with AAC, including involved eye, controlling the acute attack, the unaffected fellow eye was considered for the study before receiving any medication.

• Normal individuals accompanying with other patients

Exclusion Criteria:

• Patients with peripheral iridotomy, anti- glaucoma medication, post trabeculectomy / valve surgery

• Pseudophakic individuals

• Optic nerve disease

• Any other ocular disease

• Uveitis / secondary glaucoma

Informed valid consent of patient taken. Group A includes

(40) eyes of angle closure glaucoma spectrum patients. Group B includes (40) eyes of normal individuals All patients recruited in the study were evaluated with detailed history. A thorough physical examination was carried out in all patients including assessment of other systems for any related contributory pathology. All patients undergone a complete ophthalmologic examination. All eligible eyes undergone anterior segment imaging using Scheimpflug (Sirius) imaging and IOL Master. Anterior segment parameters including anterior chamber volume (ACV), anterior chamber angle (ACA), anterior chamber depth (ACD) from the endothelium, central corneal thickness (CCT) and keratometry (KR) was measured by Scheimpflug imaging. For each patient, Scheimpflug imaging was performed twice within a 5-minute interval and the mean values were considered for analysis. The ACA, ACV and ACD measurements were obtained in each Scheimpflug image. All measurements were performed automatically with the Scheimpflug imaging, custom software that enabled the creation of an angle and measured the distance between the optical signals with the highest reflectivity at the tissue using iris and posterior cornea surface as the reference plans. The horizontal line (nasal and temporal), and only the smaller angle of the two measurements (nasal and temporal) was automatically adopted. Lens thickness (LT), vitreous length (VL) and axial length (AL) were measured using IOL master. Although measurement of lens thickness and densitometry are possible with Scheimpflug imaging, these were not obtained because they require pupil dilatation. White to white corneal diameter is also measured by IOL Master.

Data was collected and compiled using Microsoft Excel 2013, analysed using SPSS 23.0 version.

Results

Table 1: Distribution of patients according to Age and gender

	Group A N	Group B N	Total N (%)
Age Group (years)			
40 to 50	14	16	30 (37.5)
51 to 60	18	20	38 (47.5)
61 to 70	6	4	10 (12.5)
>70	2 (4)	0	2 (2.5)
Gender			
Male	18	14	32 (40)
Female	26	22	48 (60)

In present study patients were from age group between 51 - 60 years in both the groups i.e. 18 in group A (Angle closure glaucoma spectrum eyes) and 20 in group B (eyes of normal individual) followed by 40 - 50 years 14 in group A and 16 in group B. 40% were male and 60% were females.

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Table 2: Distribution of Eyes according to Diagnosis

Diagnosis	N	%
Primary Angle Closure Suspect	48	60
Primary Angle Closure	12	15
PACG	16	20
Acute Angle Closure crisis	4	5

In present study primary angle closure suspects eyes were most common (60%), followed by PACG (20%) and primary angle closure (15%).

Table 3: Comparison of Anterior chamber Parameter

Parameter	Group A (Mean±SD)	Group B (Mean±SD)	P value
ACD	2.00±0.28	2.86±0.24	0.001
ACV	74.78±16.00	138.22±12.18	0.001
ACA	28.62±7.03	43.07±7.13	0.001
ACV/AL	3.32±0.78	6.04±0.64	0.001
ACV/KERATOMETRY	1.66±0.34	3.16±0.34	0.001
ACV/WTW	6.34±1.38	12.64±1.16	0.001
ACV/LT	15.10±4.06	32.64±4.46	0.001

In present study anterior chamber parameters in both the groups were more in group B (eyes of normal individual) than in group A (Angle closure glaucoma spectrum eyes). Also ACV/AL, ACV/KERATOMETRY, ACV/WTW, ACV/LT were more in group B(eyes of normal individual) than group A(Angle closure glaucoma spectrum eyes) and this difference was statistically significant.

Table 4: Comparison between PACS and PAC

Parameter	PACS (Mean±SD)	PAC (Mean±SD)	P value
ACD	2.00±0.26	2.22±0.28	0.01
ACV	72.38±12.38	84.90±22.78	0.03
ACA	27.53±5.38	33.47±8.04	0.007
ACV/AL	3.35±0.66	3.78±1.02	0.05
ACV/KERATOMETRY	1.64±0.32	1.96±0.62	0.01
ACV/WTW	6.32±1.22	7.17±1.94	0.07
ACV/LT	15.96±3.54	18.04±5.70	0.02

All anterior chamber parameters were more in PAC eyes than in PACS eyes and this difference was statistically significant in all parameters (p value <0.05) except in ACV/AL and in ACV/WTW.

Table 5: Comparison between PACS and PACG

Parameter	PACS (Mean±SD)	PACG (Mean±SD)	P value
ACD	2.00±0.28	1.88±0.22	0.07
ACV	74.46±13.37	67.26±12.06	0.28
ACA	26.54±5.35	28.34±7.73	0.15
ACV/AL	3.34±0.66	3.06±0.54	0.19
ACV/KERATOMETRY	1.64±0.32	1.56±0.32	0.42
ACV/WTW	6.32±1.22	6.04±1.16	0.46
ACV/LT	15.95±3.54	14.96±3.16	0.36

In comparison between PACS and PACG for anterior chamber parameters, all parameters were more in PACS eyes than in PACG eyes, this difference was not statistically significant in all above parameters (p value>0.05).

Table 6: Comparison between PACS and Acute Angle closure crisis

Parameter	PACS (Mean±SD)	Acute Angle Closure crisis (Mean±SD)	P value
ACD	2.00±0.24	1.76±0.24	0.16
ACV	74.42±15.35	52.00±5.65	0.07
ACA	27.53±5.35	12.48±0.72	0.001
ACV/AL	3.34±0.66	2.38±0.28	0.08
ACV/KERATOMETRY	1.64±0.32	1.16±0.14	0.07
ACV/WTW	6.32±1.22	4.48±0.56	0.02
ACV/LT	15.96±3.54	10.64±1.34	0.05

In comparison between PACS and Acute Angle closure crisis, for anterior chamber parameters, all parameters were more in PACS eyes than in Acute Angle closure crisis eyes and this difference was statistically significant (p value <0.05) except in ACD.

Discussion

To effectively prevent PACG by the use of prophylactic laser iridotomy, it is necessary to identify people with anatomically narrow angle. [13] It has been shown that without treatment, 22% of PACS eyes progress to PAC over a period of 5 years. Additionally, the 5-year incidence for progression from PAC to PACG was shown to be 28.5%. [14] As damage by acute angle closure (AAC) is irreversible, prophylactic laser peripheral iridotomy (LPI) of PACS eyes with high risk characteristics for developing AAC is crucial. [15] Anterior chamber angle and depth have been identified as an important risk factor for angle-closure glaucoma. Apart from gonioscopy quantitative imaging modalities such as ultrasound biomicroscopy, optical coherence tomography, and Scheimpflug imaging have been developed for Anterior chamber measurements. [16,17]

Scheimpflug photography is the basis for a number of devices that can image the anterior segment. The technology is highly versatile, with potential applications in the areas of keratorefractive surgery, corneal biomechanics, corneal ectasia evaluation, anterior segment imaging, cataract grading, and surgical planning for femtosecond laser-assisted cataract surgery. [15,18] In present study patients were from age group between 51 - 60 years in both the groups i.e. 18 in group A (Angle closure glaucoma spectrum eyes) and 20 in group B (eyes of normal individual) followed by 40 - 50 years 14 in group A and 16 in group B. 40% were male and 60% were females.

In present study primary angle closure suspects eyes were most common (60%), followed by PACG (20%) and primary angle closure (15%). Mohammad Pakravan et al [19] studied comparison between acute angle closure, PACS and normal eyes in which they mentioned that Mean anterior chamber volume was 72±18, 77±18 and 176±44 μl in these groups and were statistically significant. They also compared ACA, ACD and observed that it was statistically significant as in our study. Also anterior chamber volume in primary angle closure suspects before and after peripheral iridotomy in which they found significant difference. In another study by George et al [20] no significant difference in biometric values was found between angle closure glaucoma and occludable angles, however they were significantly different from normal eyes; this observation is also in line with our findings.

In present study anterior chamber parameters in both the groups were more in group B (eyes of normal individual) than in group A (Angle closure glaucoma spectrum eyes). Also ACV/AL, ACV/KERATOMETRY, ACV/WTW, ACV/LT were more in group B(eyes of normal individual) than group A(Angle closure glaucoma spectrum eyes) and this difference was statistically significant. All anterior chamber parameters were more in PAC eyes than in PACS eyes and this difference was statistically significant in all parameters (p value <0.05) except in ACV/AL and in ACV/WTW. In comparison between PACS and Acute Angle closure crisis, for anterior chamber parameters, all parameters were more in PACS eyes than in Acute Angle closure crisis eyes and this difference was statistically significant (p value <0.05) except in ACD. Matthew T. Feng et al [21] studied ACD in normal individuals using Scheimpflug imaging mentioned that ACD did not vary significantly in the countries studied, with the notable exception of New Zealand. Surgeons should anticipate a greater likelihood of a shallow ACD when evaluating glaucoma patients Middle-aged subjects had more crowded anterior chambers than young subjects with similar axial lengths. Anterior chamber volume may be a more sensitive parameter to reveal this difference than a linear measurement of the anterior chamber depth. Anterior segment imaging modalities such as Scheimpflug imaging may help define and detect high risk eyes.

Conclusion

In present study all anterior chamber parameters were more in normal eyes compared to angle closure glaucoma spectrum and mean difference was significant. Scheimpflug imaging can be a very useful tool in differentiating angle closure glaucoma spectrum from normal individuals, but it cannot differentiate between the patients within the spectrum like primary angle closure suspect versus primary angle closure versus primary angle closure glaucoma.

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