Role of Lens Vault in Angle Closure: Hospital Based Study at a Tertiary Care Center

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Abstract
Problem: Crystalline lens has a mechanistic role in eyes with narrow angles, either independently or in combination of other ocular biometric parameter. We have tried to assess role of lens vault in patients of angle closure presenting to our glaucoma OPD. Approach: It was prospective hospital based cross sectional study. The lens vault measured on anterior segment optical coherence tomography in patients of primary angle closure with age 40-70 years and cataract grade 2 and 3 (LOCS) and compared to age and cataract matched controls. Results calculated using chi-square and student t test as required. **Findings**: Present study compared 100 cases of angle closure and 100 cases as controls from similar age and cataract grade matched normal population. Mean age of patients in angle closure group was 52.40 ± 6.73 years. Mean age of normal control population group was 51.48 ± 5.47 years. The difference was statistically insignificant. Number of subjects of angle closure with grade 2 cataract were 38 and grade 3 cataract were 62. Cataract grading in normal control group were grade 2 in 46 cases and grade 3 in 54 cases. The difference was statistically insignificant. The mean lens vault in patients of angle closure group was 898.14 ± 26.5 µm. The mean lens vault in patients of normal control group was320 ± 27.2 µm. The difference was highly significant. **Conclusion:** In the presence of visually significant cataract, consider lens extraction as the initial treatment option for the management of primary angle closure.
Keywords: angle closure; anterior segment Optical Coherence Tomography; lens vault.

Introduction

There are multiple anatomical & physiological factors documented in books for PACG (primary angle closure glaucoma). Lens related factors is second cause after pupillary block in this causation. As per literature the lens vault, position and thickness play important anatomical role in this pathogenesis. [1] It is helpful to assess these parameters not only for better understanding but also for diagnosis and treatment of angle closure. We have tried to assess lens vault in patients of angle closure presenting to our glaucoma OPD.

Material and method

It was prospective hospital based cross sectional study. Patients participating in this study were 100 cases of primary angle closure with age 40-70 years and cataract grade 2 and 3 (LOCS) presenting to glaucoma clinic of our hospital. The study was done after obtaining clearance from the Institutional Ethical Committee and sticks to ethical standards of the responsible committee. Informed consent obtained from the patients recruited. We measured the lens vault on anterior segment optical coherence tomography (AS-OCT) (NIDEK, RS 3000 Advance Optical Coherence Tomography). Lens vault (LV) is defined as the perpendicular distance between the anterior crystalline lens surface and the horizontal line joining the two scleral spurs.[2] Cataract grading was done as per Lens Opacities Classification System (LOCS). The patients compared to 100 normal age and

cataract matched cases to avoid any bias. Cases of secondary angle closure, open angle glaucoma cases, patients with any prior ocular surgery for glaucoma or otherwise and patients not willing to participate in the study were excluded from the study. Data collected and tabulated. The SPSS software (version 22.0, IBM Corp., Armonk, New York, USA) used for the statistical analysis. Results calculated using chi-square and student t test as required.

Results

Present study involved 100 cases of angle closure and 100 cases as controls from similar age matched normal population. Mean age of patients inangle closure group was 52.40 ± 6.73 years. Mean age of normal control population group was 51.48 ± 5.47 years. The difference was statistically insignificant (Table 1). Number of subjects of angle closure with grade 2 cataract were 38 and grade 3 cataract were 62. Cataract grading were comparable in normal control group with grade 2 in 46 and & grade 3 in 54 cases. The difference was statistically insignificant (Table 2). The mean lens vault in patients of angle closure group was 898.14 ± 26.5 µm. The mean lens vault in patients of normal control group was320 ± 27.2 µm. The difference was highly significant (table 3).

Discussion

Glaucoma is the most common cause of irreversible vision loss worldwide. Estimated number of PACG in 2020 was 30million as compared to 63 million POAG case.[3] But Blindness rate is 33-75% in PACG as opposed to 11-27% visual loss in POAG (primary open angle glaucoma). The crystalline lens is considered to play a considerable role in pathogenesis of angle closure by causing reduction in depth of anterior chamber, thereby causing crowding of angles.[4] It has been documented in literature that lens vault, position and thickness play important anatomical role in this pathogenesis.[4] Eye with angle closure have thicker and anteriorly placed lens, with greater lens vault as compared to normal eye. There is an increased risk of angle closure in such eye.

The Anterior segment OCT (AS-OCT) is a noncontact, noninvasive imaging modality that uses low–coherence light to provide high-resolution cross–sectional images of the anterior segment.[5] Advent of AS-OCT has made assessment of these parameters convenient, handy and quick.[6]

As seen in present study, the lens vault in patients of angle closure was far more significantly higher than the normal matched controls (Table 3).The subjects in the study well matched in aspect of age (Table 1) and cataract grading (Table 2), which could have been a bias. The result collaborates well with other studies in literature. [7]

Thus, lens plays a major mechanistic role in angle closure, either independently or as a part of pupillary block.[7] This reinforces the fact that surgical extraction of the lens should be considered in angle closure patients with a co–existing cataract. Similar fact elucidated in results of the EAGLE (Effectiveness of early lens extraction for the treatment of primary angle closure glaucoma) study. It proved that clear lens extraction was associated with greater clinical effectiveness (control of IOP, reduction of number of medications and need for glaucoma surgery), offered better quality of life and was more cost–effective than LPI (laser peripheral iridotomy) for patients over 50 years of age with PAC and IOP > 30 mmHg or PACG.[8] The IOP reduction induced by lens extraction can reach up to 30% in PACG eyes postoperatively. [9] Additional longitudinal studies are required to evaluate the clinical utility of ocular biometrics as a diagnostic standard for personalizing the management of angle-closure eyes.

Conclusion

The prevalence of PACG is expected to increase over the next two decades, so identifying patients at increased risk of developing the condition is a public health priority.[2] Lens has a mechanistic role in eyes with narrow

angles. In the presence of visually significant cataract, offer lens extraction as the initial treatment option for the management of PACG

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Table 1: Comparison of age between angle closure and normal control group

	Angle closure group (n=100)	Normal control group (n=100)	p value
	Mean ± SD	Mean ± SD	
Age (yrs)	52.40 ± 6.73	51.48 ± 5.47	0.342

Test used: Student's t test

Table 2: Comparison of frequency of grades of cataract between angle closure and normal control group

	Angle closure group		Normal control group		p value
	Frequency	%	Frequency	%	0.316
Grade 2	38	38.0%	46	46.0%	
Grade 3	62	62.0%	54	54.0%	
Total	100	100%	100	100%	

Test used: Chi square test

Table 3: Comparison of lens vault between angle closure and normal control group

Measures	Angle closure group (n=100	Normal control group (n=100)	Mean difference (95% CI)	p value
	Mean ± SD	Mean ± SD		
LENS VAULT (LV)(μm))	898.14 ± 26.5	320.47 ± 27.2	578 (475,651)	<0.001*

Test used: Student's t test

*signifies highly significant p value