ORIGINAL RESEARCH PAPER

Medical Science

EVALUATION OF SPECTRAL DOMAIN THREE DIMENSIONAL ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY AS A TOOL IN THE DIAGNOSIS OF PRIMARY ANGLE CLOSURE GLAUCOMA AND PRIMARY ANGLE CLOSURE SUSPECTS

KEY WORDS: Anterior Segment SD-OCT, Gonioscopy, Primary angle closure suspects, Primary angle closure glaucoma.

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ABSTRACT

Objective: Evaluation of Spectral domain three dimensional anterior segment optical coherence tomography (SD-3D-AS-OCT) as a tool in the diagnosis of primary angle closure glaucoma and primary angle closure suspects.
Design: Prospective, Randomized, observational study.
Methodology: Patients were divided into two categories as Primary angle closure suspect – Category 1, Primary angle closure glaucoma as Category 2. All patients underwent Gonioscopy & AS-OCT by single examiner.
Outcome measures: In our study we found that significant number of patients showed ITC more in PACG than PACS. ITC of nasal angles of PACG and PACS was closed more than temporal side. Among all angle parameters AOD 500 is the best in evaluating angle closure by using OCT.
Results: The study implys that the role of angle parameters such as Irido trabecular contact length, Trabecular iris angle, angle opening distance by SD OCT in diagnosing PACS & PACG is advantageous than Gonioscopy. SD OCT has high sensitivity and low specificity.
Conclusions: The SD OCT has high sensitivity in evaluation of closed/ occludable angles than the Gonioscopy. Low specificity remains demerit of the novel SD OCT technology, which makes unreliable as a diagnostic tool in angle closure glaucoma & suspect.

INTRODUCTION

Glaucoma is the leading cause of irreversible blindness worldwide. Primary angle closure glaucoma is a major cause of blindness worldwide, accounting for bilateral blindness in more than almost 5.3 million people by 2020.[1]

Traditional slit-lamp technique used to screen for narrow or occludable angles are the Van Herrick test. Overestimation of angle width is a common error when the slit beam is inadvertently moved too far on to the cornea.

Gonioscopy is common standard technique that provides semi quantitative assessment of the angle width. Limitations are subjective skill, placing the gonio lens alter the angle configurations, illumination. Thus, quantitative and objective assessment of the anterior chamber angle (ACA) is crucial for determining the risk of angle closure. The technology of optical coherence tomography (OCT) has evolved rapidly from time-domain to spectral-domain and swept-source OCT over the recent years Imaging of the anterior segment of the eye offers an objective method for visualizing the angle and adjacent anatomical structures.

AIM

Evaluation of SD-3D-AS-OCT as a tool in the diagnosis of primary angle closure glaucoma and primary angle closure suspects.

METHODS

The study "Evaluation of SD-3D-AS-OCT as a tool in the diagnosis of primary angle closure glaucoma and primary angle closure suspect" was carried out at Regional Institute of Ophthalmology, Indira Gandhi Institute of Medical Sciences, Patna, Bihar during period 2014-16. The study conformed to the Helsinki declaration (world medical association, 1995) and applicable guideline for good clinical practices was looked into consideration. Written informed consent was obtained from each participant before enrolment. All subjects underwent general and systemic examination, through baseline ophthalmic evaluation, including medical history, Best Corrected Visual Acuity (BCVA), Intra Ocular Pressure (IOP) measurement by Goldmann Applanation Tonometry (corrected according to central corneal thickness), gonioscopy, undilated and Slit Lamp Biomicroscopy using +90 Diopter lens for Fundus evaluation.

Angles graded by R P Centre grading system that cutoff for inclusion was<= 3 at least in 180 degrees with or without glaucomatous RNFL abnormality. The nasal and temporal quadrants of Gonioscopy compared with corresponding angle parameters by SD OCT.

Locating the scleral spur in an AS-OCT image depends on cues such as high pixel reflectivity in the region of the scleral spur, inward protrusion of the sclera, and a subtle change in the contour of the inner sclera margin.[2] Precise location of the scleral spur is a pre-requisite for reliable measurement of the angle. Parameters including the angle-opening distance (AOD), trabecular iris angle (TIA), angle recess area (ARA), and trabecular iris space area (TISA) have been widely adopted to measure the angle dimensions and all of them are measured with reference to the scleral spur (Figure 1).[3]

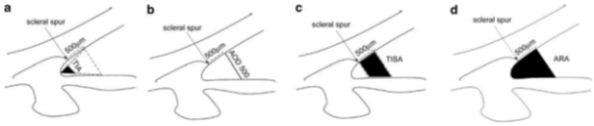

Figure 1)
(a). Measurement of trabecular iris angle (TIA; TIA 500 is defined as an angle measured with the apex in the iris recess and the arms of the angle passing through a point on the trabecular meshwork 500 mm from the scleral spur and the point on the iris perpendicularly.
(b) Angle-opening distance AOD 500 is calculated as the

perpendicular distance measured from the trabecular meshwork at 500 mm anterior to the scleral spur to the anterioriris surface.

(c) Trabecular iris space area (TISA): The TISA 500 is an area bounded anteriorly by the AOD 500; posteriorly by a line drawn from the scleral spur perpendicular to the plane of the inner scleral wall to the opposing iris; superiorly by the inner corneoscleral wall; and inferiorly by theiris surface.

(d) Angle recess area ARA 500: is the area of the angle recess bounded anteriorly by the AOD 500.[4]

The TICL is defined as the linear distance of iris contact with the corneo-scleral surface beginning at the scleral spur and extending anteriorly in an anatomically apposed or synechially closed angle.[5]

Statistical analysis:

The collected data were analyzed using SPSS software. The data analysis was done by using Chi square test and obtained 2x2 cross tabulations.Then calculated diagnostic credentials sensitivity, specificity, positive predictive value, Negative predictive values.

RESULTS

The study included 144 eyes of 90 patients with a mean ±SD age of 56±9 years (range 30- 77 years). Forty seven (52.2%) patients were female and 43 male(47.7%).

Madanmohan`s grading ≤ 3 were identified in 137 (95.1%) superiorly, 47(32.6%) inferiorly, 133 (92.9%) nasally and 120 (83.3%) temporal quadrants, respectively.

Anterior segment imaging of all 4 sides were obtained. Scleral spur(land mark for calculation of TIA,TICL,AOD) was not clear in superior and inferior OCT images. Hence Nasal and Temporal quadrants of Gonioscopy compared with corresponding OCT angle parameters values.

As ,cut off values for Indian eyes are not available, we have analysed our data based on the study conducted by Radhakrishan S[6] ,Narayana swamy et al[7] where the cut off values in detecting narrow angles were TICL >=1,AOD 250<=140,AOD 500 <=190, AOD 750<=260. TIA <=22 degrees as defined by Wirbelaur C[8] et al.

OCT detected closed angles i.e TICL>=1 in 137(95.13%) (48 PACS(80%),89 PACG(98%))& 127(88.19%) (50 PACS(83.3%), 77 PACG(85.5%) at medial and lateral scan respectively.
OCT detected angles <=22 in 113(78.4%) (39 in PACS (65%)& 74 in PACG

(82.2%)) & 111(77%) (37 in PACS (61.6%) & 74 in PACG (82.2%)) at medial & lateral scan respectively.

DISCUSSION

Imaging of the anterior segment of the eye offers an objective method for visualizing the angle and adjacent anatomical structures. In addition to qualitative analyses, some imaging modalities permit quantitative analyses that can be used to monitor change or progression over time. Several imaging devices are described to understand potential benefits and limitations of anterior segment optical coherence tomography (AS-OCT). Previous studies have shown good repeatability and reproducibility for measurement of AOD, TISA, ARA and TIA with anterior segment OCT.[9-12]

In our study we found that significant number of patients showed ITC more in PACG than PACS. ITC of nasal angles of PACG and PACS was closed more than temporal side.[13] Among all angle opening distance parameters AOD 500 was the best in evaluating angle closure by using OCT.[4,7,8,14.]

Our data of TIA & AOD shows more angle closure in nasal quadrant than temporal in both PACG & PACS. Closed angles more detected by OCT than Gonioscopy. High sensitivity & low specificity of OCT over gonioscopy (chi square test p Value =0.063) but statistical difference does not reached.

Like ITC, TIA & AOD (250 ,500 ,750) of nasal side of PACG and PACS is more close than Temporal side. The ability to detect closed angles is by SD OCT(95.16%) more than Gonioscopy (93.75%).. AOD 500 has high sensitivity and low specificity.[7,14.]

Figure No: 2 Bar chart showing Sensitivity & Specificity of OCT parameters

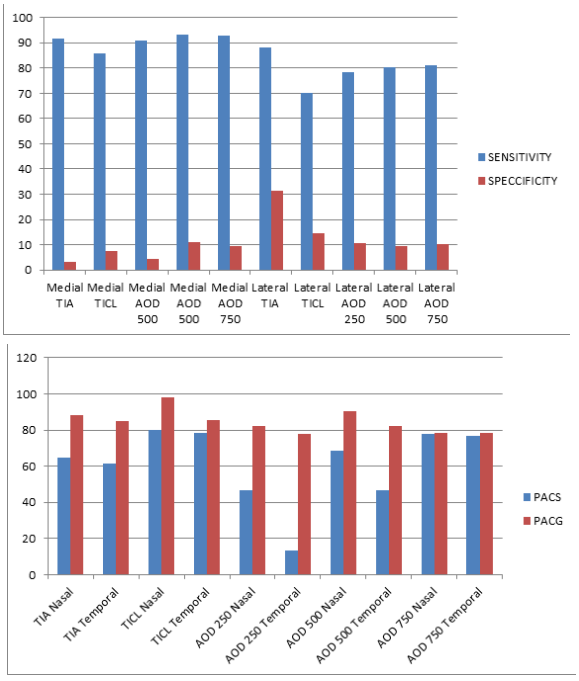

Figure:3 Bar chart showing, percentage of closed angles detected by SD OCT by using quantitative OCT angle parameters at nasal & temporal quadrants in PACS & PACG.

Agreement between Gonioscopy and SD OCT is more in nasal quadrant than temporal side.

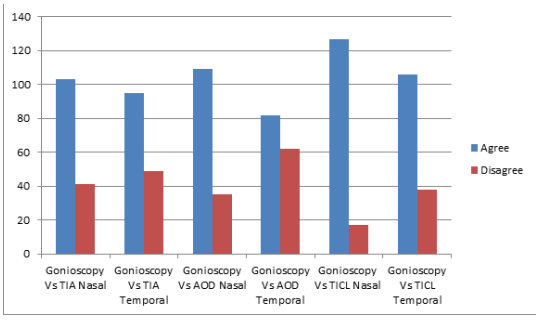

Figure:4 Bar chart shows variation between gonioscopy and quantitative SD OCT parameters of nasal and temporal quadrants in detecting narrow angles.

Conclusion:

The SD OCT has high sensitivity in evaluation of closed/ occludable angles than the Gonioscopy. Low specificity remains demerit of the novel SD OCT technology, which makes unreliable as a diagnostic tool in angle closure glaucoma & suspect.

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