Original Research Article

To study the relation between central corneal thickness, intro ocular pressure and visual field changes in primary open angle glaucoma

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A B S T R A C T

Aims and Objectives: To correlate 3 important factors central corneal thickness, intraocular pressure and visual field changes in the POAG suspects which it helps to predict the onset of POAG and in early diagnosis.

Materials and Methods: In this prospective study, a total 100 patients from 40 to 70 years of age diagnosed as PAOG suspects were included in the study. Slit lamp bio microscopy, ultrasound pachymetry was done to measure CCT and IOP was measured with Goldman applanation tonometer the visual field assessment was done with the octopus field analyser.

Results: The patient population consisted of 42 females and 58 males with average age of 51.7 years. Significant and moderate positive correlation between the CCT and IOP was observed for the right side (r)=0.39 and left side(r)=0.36 statistically significant (P=0.001). In our study highest percentage of abnormal (glaucomatous) visual field changes was seen in eyes with low CCT (<510μm) (P=0.008). Mean corrected IOP reading was 21.43 mmHg for the 14 patients with abnormal visual fields on right side and this was statistically significant at P=0.01.

Conclusion: Thinner corneal readings in south Indian population especially when presenting at younger age should alarm the ophthalmologist to evaluate the patient thoroughly for glaucoma and should be followed up for the progression of glaucoma.

1. Introduction

Primary open angle glaucoma (POAG) is a type of glaucoma defined as open, normal appearing anterior chamber angle and raised intraocular pressure (IOP), with no other underlying disease.

POAG is typically characterized by

1. An open, normal-appearing anterior chamber angle and increased intraocular pressure (IOP) without any apparent ocular or systemic abnormality that might account for the elevated IOP.
2. Typical optic nerve head damage.
3. Glaucomatous visual field damage.

Glaucoma is the third leading cause of blindness in India and accounts for 5.80% of total blindness in India.[1] It is the leading cause of irreversible blindness in general population worldwide.[2,3] The estimated prevalence of glaucoma in the world was 60.5 million in 2010 and is expected to rise to 79.6 million by 2020.[4]

A glaucoma suspect is an individual with clinical findings and/or a constellation of risk factors that indicate an increased likelihood of developing primary open-angle glaucoma (POAG).POAG suspects are individuals with at least one of the following features in one or both eyes like suspicious cupping of optic disc/ visual field defect suspicious for glaucomatous damage/elevated intraocular pressure in the presence of normal optic disc, visual fields. POAG is a multi-factorial disease with a devastating impact on the quality of life of the patient in the moderate

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and severe stages of the disease. Recognition of all risk factors for POAG is important for early diagnosis and intervention.[5]

POAG is often diagnosed on routine ocular examination and in many instances in the late stage. It manifests mainly as peripheral visual field loss with central vision being preserved almost till the end stage.[6]

In this study, our objective is to correlate Central corneal thickness, intraocular pressure & Visual field changes in patients diagnosed as the POAG suspects.

In order to accurately identify patients at risk of developing glaucoma so that treatment of high-risk individuals can be considered to prevent/delay the development of POAG.

2. Materials and Methods

2.1. Study design

It was a prospective, non-interventional, comparative study conducted at Dr. B.R. Ambedkar medical college & hospital, Bangalore after taking ethical approval of the institutional ethical committee.

2.2. Sample size

The study included 200 eyes of 100 patients who attended the outpatient department over a period of 1 year, 6 months. All patients were between age group of 40 & 70 years & clinically diagnosed as primary open angle glaucoma suspects.

2.3. Inclusion criteria

1. Patients aged between 40 to 70 years.
2. Patients with open anterior chamber angles on gonioscopy.
3. Patients with Consistently elevated IOP (>21mmHg) associated with normal appearance of the optic disc and retinal nerve fiber layer and with normal visual field test results.
4. Patients with visual field suspicious for glaucomatous damage in the absence of clinical signs of other optic neuropathies, elevated IOP and optic disc changes.
5. Patients with optic disc or retinal nerve fiber layer that is suspicious for glaucomatous damage in the absence of elevated IOP or visual field changes.

2.4. Exclusion criteria

1. Patients aged <40 yrs. Or >70 yrs.
2. Patients who have 2 or more of the following: Consistently elevated IOP, visual field suspicious for glaucomatous damage, optic disc or retinal nerve fiber layer that is suspicious for glaucomatous damage
3. Patients with angle closure on gonioscopy.
4. Patients already on Glaucoma treatment.

5. Patients who have undergone Glaucoma surgery/Refractive surgery/Cataract surgery.
6. Patients with secondary causes for open-angle glaucoma, such as pseudoexfoliation (exfoliation syndrome), pigment dispersion, and traumatic angle recession.

2.5. Method of collection of data

After taking consent of the patients, detailed ocular, systemic & family history was taken. Any history of refractive errors, use of corrective glasses or contact lenses, glaucoma, use of topical steroids & any previous records with respect to IOP, optic nerve head status or visual field was taken. Any history of ocular surgery like cataract/ LASIK/ photorefractive keratectomy was noted. This is important as refractive error correction procedures are known to be associated with thinning of cornea & hence falsely low IOP and cataract surgery has been associated with lower IOP as compared to pre-surgery baseline.

2.6. Ophthalmological examination

The BCVA was assessed using an illuminated Snellen's chart, with the patient seated at 6 meters distance. Near vision was assessed using Jaeger's near vision chart. Colour vision was checked using Ishihara's pseudo-isochromatic charts. Slit lamp examination was performed to rule out any corneal/anterior segment pathology or infections. Gonioscopy was performed with Goldmann three-mirror lens and the anterior chamber angle was graded according to Modified Shaffer's grading. Only patients with open anterior chamber angles were included in this study.

Detailed fundus examination by indirect ophthalmoscopy, followed by Slit-lamp biomicroscopic evaluation with 90 D lens. Posterior pole & Optic Nerve Head findings were noted down.

3. Results

The patient population consisted of 42 females and 58 males with average age of 51.7 years. The mean CCT was 518.91 ± 24.26 μm, 522.19±21.56 μm among females, males respectively. The mean uncorrected IOP (GAT) was 19.50 mm Hg and 20.14 mmHg on right, left sides respectively statistically significant (P=0.003). The corrected was 19.50 mm Hg and 20.03 mmHg right and left side respectively the difference being statistically significant (P=0.01). Significant and moderate positive correlation between the CCT and IOP was observed for the right side (r) = 0.39 and left side(r)=0.36 statistically significant (P=0.001).

In our study highest percentage of abnormal (glaucomatous) visual field changes was seen in eyes with low CCT (<510μm) (P=0.008). Mean corrected IOP reading was 21.43 mmHg for the 14 patients with

Table 1: Age & gender distribution among study subjects

Variables	Categories	Mean	SD
Age	Mean & SD	51.7	6.1
	Range	40-65	
Sex	Male	58	58%
	Female	42	42%

Table 2: Comparison of mean CCT between genders using independent student t test

Sex	N	Mean	SD	Mean Diff	t	P-value
Sex	58	522.19	21.56	3.29	0.713	0.48
Females	42	518.91	24.26			

Table 3: Distribution of Central Corneal Thickness [CCT] as normal, low, high CCT

Distribution of Central Corneal Thickness [CCT] among study subjects

Sides	CCT	n	%
Right	Normal	43	43%
	Low CCT	30	30%
	High CCT	27	27%
Left	Normal	43	43%
	Low CCT	26	26%
	High CCT	31	31%

Normal CCT= (510-530um), Low (<510um), High (>530um).

Table 4: Comparison of CCT with visual field changes on right & left side using chi-square test

Comparison of CCT on the right & left sides with corresponding visual filed changes using chi square test

Sides	CCT	Normal		Abnormal		2 value	P-value
		N	%		%		
Right Side	Normal	41	47.7%	2	14.3%	9.687	0.008*
	Low CCT	21	24.4%	9	64.3%		
	High CCT	24	27.9%	3	21.4%		
Left Side	Normal	39	45.3%	4	28.6%		0.27
	Low CCT	20	23.3%	6	42.9%	2.598	
	High CCT	27	31.4%	4	28.6%		

abnormal visual fields on right side and this was statistically significant at P=0.01. Higher sensitivity of Corrected-IOP(35.7% to 64.3%) as compared to uncorrected IOP(21.4% to 35.7%) when diagnosing POAG suspects with visual field changes suspicion for glaucoma.

4. Discussion

In our study population, the mean age was 51.7 ± 6.1 years. The mean CCT among females was 518.91± 24.26 μm & among males was 522.19± 21.56 μm. CCT was divided into 3 categories i.e Low (<510 μm), Normal (510-530 μm) & High (>530 μm). The mean IOP (GAT) on right side was 19.50 mmHg & on the left side was 20.14 mmHg & was statistically significant at P=0.003. In our study, out of 3 categories highest % of abnormal visual field changes was seen in eyes with low CCT that is thin cornea. OHTS results showed high IOP correlated with visual field defects. In the blue mountains eye study, the mean age of the study population was 66.2±9.8 years and that of OAG was 75.9±

8.6 years.[7] In the Aravinda Comprehensive Eye survey, median age of those with glaucoma was 60.0 years (mean 60.8 years).[8]

In our study we got a mean corrected IOP reading of 21.43 mmhg for the 14 patient with abnormal visual fields which was statically significant. In our study highest percentage of abnormal visual field changes was seen in eyes with low CCT (<510). Therefore knowledge of CCT can help to attribute the likelihood of disease progression and assigning the risk can change clinical management decisions to reach a personalized target pressure. In our study population the mean age was 51.7 years. Thinner cornea reading in our south Indian population especially when presenting at younger age should alarm the ophthalmologist to evaluate the patient thoroughly for glaucoma and monitored follow up to keep a check on the possible progression.

5. Source of Funding

6. Conflict of Interest

No conflict of interest.

7. Acknowledgement

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