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Study of Correlation of Retinal Nerve Fiber Layer Thickness and Optic Disc Parameters With Visual Field Changes in Glaucoma Suspects And Diagnosed Cases of Primary Open Angle Glaucoma

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Abstract: *Glaucoma is one of the important causes of irreversible preventable blindness. Examining and monitoring the ONH (optic nerve head) and the RNFL (retinal nerve fibre layer thickness) structurally and functionally, is important for diagnosis and treatment. Functional loss recorded with automated static threshold perimetry is both sensitive and specific to early loss and provides quantitative data for the monitoring of change. 30 eyes of 30 Glaucoma suspect patients and 30 eyes of 30 POAG (Primary open angle Glaucoma) were evaluated over a duration of 18 months in a prospective, non-randomised study. All patients underwent complete ocular examination including gonioscopy, retinal nerve fiber layer thickness and optic disc parameters using Stratus OCT. A detailed field evaluation was carried out using Automated Perimetry-Humphrey Field Analyser.*

We concluded that in glaucoma suspects, RNFL thinning was present with minimal or no visual field sensitivity loss. In the POAG group, the RNFL thickness and optic disc parameters were well correlated with visual field changes OCT is capable of detecting changes at the level of RNFL in Glaucoma suspects with normal appearing discs and visual fields. Hence OCT can serve as a useful guideline in diagnosis, management, prognostication and research in Glaucoma.

Keywords*: Glaucoma, Suspect, Optical Coherence Tomography, Retinal Nerve Fiber Layer Automated Perimetry.*

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I. Introduction

Primary open angle glaucoma is a chronic, bilateral and often asymmetrical disease in adults in whom acquired loss of optic nerve fibres and abnormality in the visual field occurs with an open anterior chamber angle of normal appearance and an intraocular pressure which is detrimental to the structural and functional integrity of optic nerve head [1]. POAG is a major worldwide health concern in ophthalmology as it is usually silent and progressive in nature. It is one of the leading preventable causes of blindness in the world. With appropriate screening and treatment, glaucoma usually can be identified and its progress arrested before significant effects on vision occur. Examining and monitoring the optic nerve head and the RNFL, structurally and functionally, is important for diagnosis and treatment. Functional loss recorded with automated static threshold perimetry is both sensitive and specific to early loss and provides quantitative data for the monitoring of change [2].

Clinically, visual field loss often correlates with nerve fibre layer loss and optic nerve damage. The natural evolution of primary open-angle glaucoma implies the loss of ganglion cells and their axons in the retina. It is well established that significant amount of ganglion cell death (25 to 30%) occurs before any visual field defect is produced, thus giving rise to the concept of pre- perimetric glaucoma[3][4][5].Optical Coherence Tomography is newer noninvasive, non-contact technique of measuring thickness of retinal nerve fibre layer. It provides potential means for quantification of RNFL thickness and also for detection and documenting progression of RNFL loss. Careful evaluation of the optic nerve head and RNFL is crucial in glaucoma, not only for diagnosis, but also for providing information about the location and severity of visual field damage. OCT may be useful in glaucoma screening in high risk group[2][3][6].

The objectives of our study were as follows-

1. To assess the retinal nerve fibre layer (RNFL) thickness by optical coherence tomography (OCT) in Glaucoma suspects and Primary Open Angle Glaucoma.
2. To detect early structural changes in Glaucoma suspects to aid in the diagnosis of pre-perimetric glaucoma.

II. Materials And Methods

This was a hospital based, prospective, non-randomised study in which 30 eyes of 30 Glaucoma suspect patients and 30 eyes of 30 Primary open angle Glaucoma were evaluated over a duration of 18 months. All patients were outpatients of a tertiary care ophthalmological institute, referred to Glaucoma clinic.

Detailed history was taken from all the patients. All patients underwent a detailed clinical evaluation including:

Snellen's visual acuity testing, Refraction, Evaluation of IOP by Goldmann'sapplanation tonometry, Slit lamp biomicroscopy of anterior segment, Gonioscopy using sussmen lens, Direct ophthalmoscope, 78D, 90D, Indirect ophthalmoscopy, Fundus photography, Cirrus HD Optical Coherence Tomography and automated perimetry by Humphrey Field Analyzer.

Patients suspected and diagnosed with primary open angle glaucoma were included in the study

The patients **excluded** and not recruited into the study included those with Normotensive glaucoma, Angle closure glaucoma, Secondary glaucomas like lens related glaucoma, iris neovascularisation, trauma; Macular degenerations/maculopathies, Optic neuritis, Arteritic ischemic optic neuropathy, Chorioretinal degeneration, Toxic ambylopia

All OCT scans were performed through a dilated pupil. Scan protocols used were Fast Optic Disc Scan and Fast RNFL Thickness protocol. Visual field testing by HFA, using SITA Startegy, 30-2 threshold test pattern.

III. Results

In this study, the mean age in the suspect group was 50.90±6.14 and in POAG group was 54.40±7.51.

Table 5 1: Distribution Of Patients Based On Age.

Age in years	POAG		SUSPECT	
	No	%	No	%
40-49	10	33.3	11	36.7
50-59	9	30.0	16	53.3
60-69	11	36.7	3	10.0
Total	30	100.0	30	100.0
Mean ± SD	54.40±7.51		50.90±6.14	

The gender distributions of patients in Suspect group, 70.0% were males and 30.0% were females. In POAG group, were 83.3% were males and 16.7% were females.In suspects, Horizontal Integrated rim width was moderately correlated withaverage RNFL thickness (r = 0.362). The rim area was moderately correlated withaverage RNFL thickness (r = 0.389). Other parameters were not correlated.In POAG, the Horizontal Integrated rim width was highly correlatedwith superior RNFL thickness (r = 0.558) and average RNFL thickness (r =0.479).

The rim area was moderately correlated with superior RNFL thickness (r =0.455), temporal RNFL thickness (r = 0.379) and highly correlated with InferiorRNFL thickness (r = 0.5), average RNFL thickness (r = 0.632). The CD ratio was moderately correlated with superior RNFL thickness (r = 0.479), temporal RNFL thickness (r = 0.433), nasal RNFL thickness (r = 0.363) were highly correlated with Inferior RNFL thickness (r = 0.526), average RNFL thickness (r = 0.638).

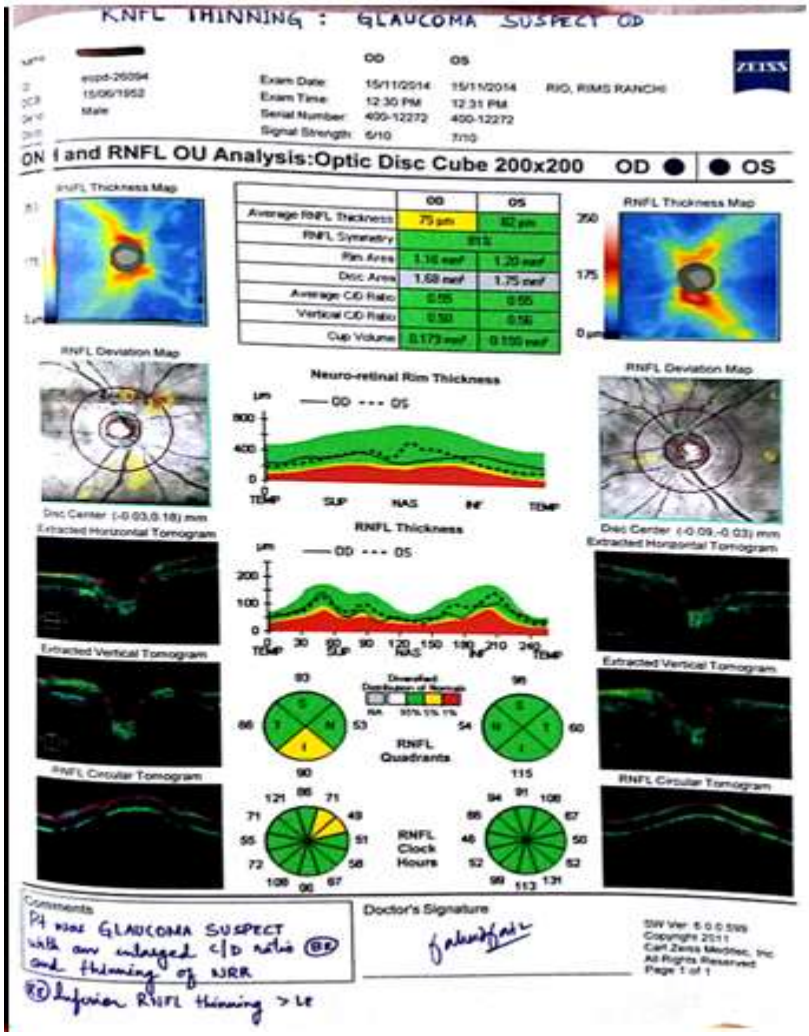

Fig 1- OCT Image shows Early RFNL Thinning in Glaucoma Suspect.

Table 2: Correlation Of Optic Disc Parameter And Rnflthickness In Suspect (Values Are Pearson Correlation R Values * Significant ** Strongly In Significant)

ODP	**RNFL thickness-SUSPECT**				
	Superior RNFL	**Inferior RNFL**	**Temporal RNFL**	**Nasal RNFL**	**Average RNFL**
Vertical Integrated rim area(mm^3)	0.355+	0.178	-0.128	-0.066	0.264
Horizontal Integrated rim width(mm^2)	0.245	0.130	-0.285	0.278	0.362*
DA(mm2)	-0.105	-0.230	0.137	-0.120	-0.254
CA(mm2)	-0.177	-0.213	0.186	-0.224	-0.404
RA(mm2)	0.183	0.037	-0.143	0.252	0.389*

	C/D RATIO	-0.360	-0.023	-0.134	0.034	-0.457		
	CD ratio Horizontal	0.023	-0.213	0.091	-0.104	-0.188		
	CD ratio Vertical	-0.043	-0.179	-0.014	-0.084	-0.323+		

Correlation of optic disc parameters and visual field changes in suspects showedno correlation between 2 parameters.In POAG group, Horizontal Integrated rim width was highly correlatedwith mean deviation (r = 0.502). The rim area was moderately correlated with mean deviation (r = 0.461). The CD ratio was highly correlated with mean deviation (r =0.499). Correlation of RNFL thickness and Visual field indices in suspects showed, no correlation between two parameters.

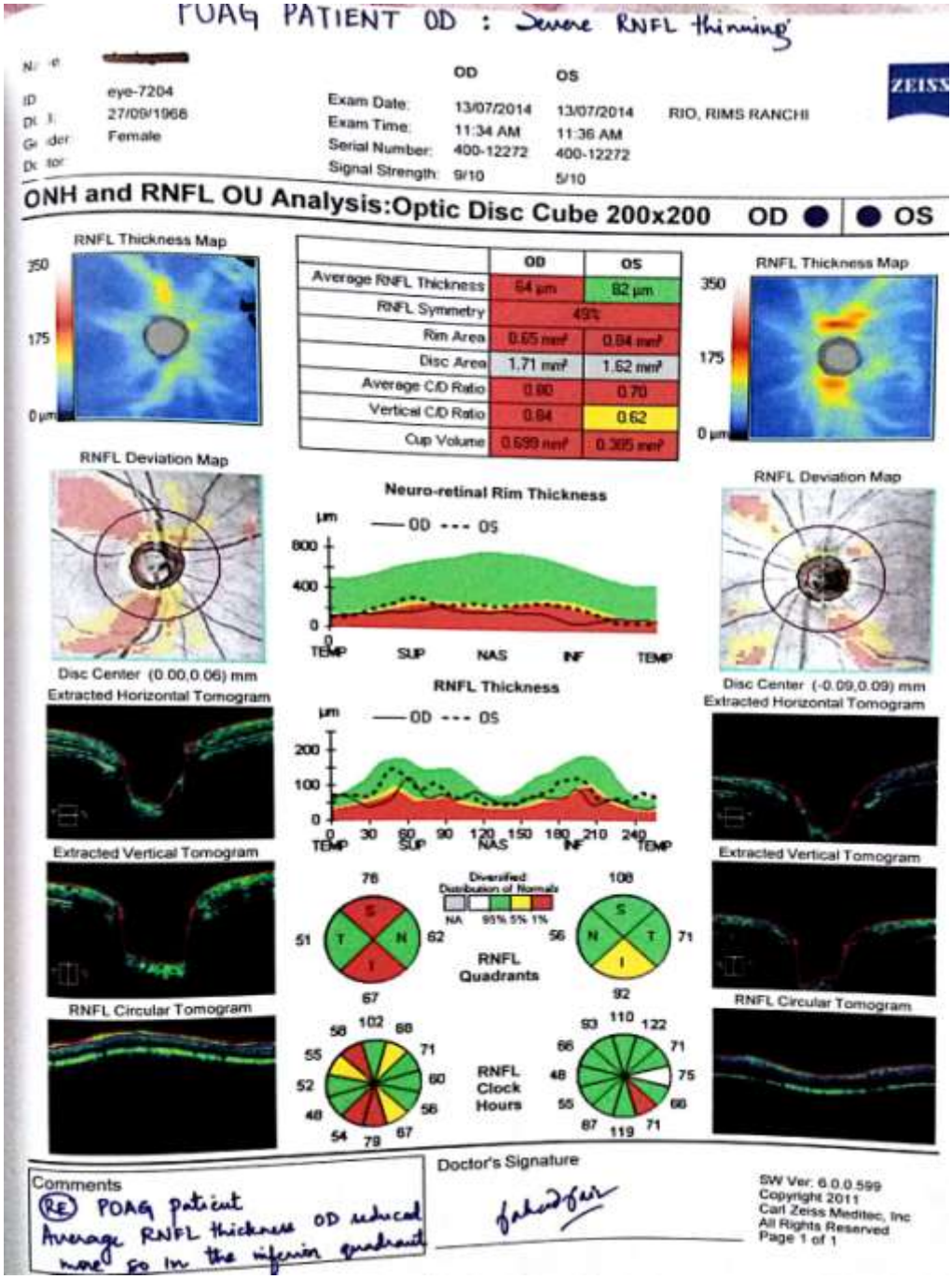

Fig 2 OCT Image showing RFNL Thinning in Primary Open Angle Glaucoma

Table 3: correlation of optic disc parameter and rnfl thickness in poag group.

ODP	RNFL thickness-POAG				
	Superior RNFL	**Inferior RNFL**	**Temporal RNFL**	**Nasal RNFL**	**Average RNFL**
Vertical Integrated rim area(mm^3)	-0.037	0.318+	0.148	-0.137	0.142
Horizontal Integrated rim width(mm^2)	0.558**	0.317	0.179	0.086	0.479**
DA(mm2)	0.292	-0.041	-0.156	0.061	0.105
CA(mm2)	-0.033	-0.295	-0.326	-0.028	-0.254
RA(mm2)	0.455*	0.500**	0.379*	0.189	0.632**
C/D RATIO	-0.479**	-0.526**	-0.433*	-0.363*	-0.638**
CD ratio Horizontal	-0.584**	-0.489**	-0.256	-0.233	-0.643**
CD ratio Vertical	-0.449**	-0.318	-0.100	0.039	-0.561**

Values are Pearson correlation r values * Significant ** Strongly in Significant

In POAG, the superior RNFL was highly correlated with mean deviation(r = 0.786), the Inferior RNFL was highly correlated with mean deviation (r =0.556), the temporal RNFL was moderately correlated with mean deviation (r =0.48). The nasal RNFL was moderately correlated with mean deviation (r = 0.447).
The average RNFL was highly correlated with mean deviation (r = 0.832).

IV. Discussion

From the study following findings evolved-

- In our study, the mean age in the suspect group was 50.90±6.14 and in POAG group was 54.40±7.51.
- In our study, the gender distribution of patients in Suspect group, 70.0% were males and 30.0% were females. . In POAG group, were 83.3% were males and 16.7% were females.
- In suspect group, the optic disc parameters were moderately correlated with retinal nerve fibre layer thickness. The optic disc parameters were not correlated with visual field indices. Correlation of RNFL thickness and Visual field indices showed no correlation between two parameters.
- In POAG group, the optic disc parameters were strongly correlated with retinal nerve fibre layer thickness. The optic disc parameters were strongly correlated with visual field indices. Retinal nerve fibre layer thickness was strongly correlated with visual field indices

RNFL thinning is a sensitive indicator of the extent of glaucomatous damage and that RNFL loss precedes measurable ONH and VF damage approximately six years before any detectable VF defects. Thus, the possibility of detecting these defects in areas of physiological decreased visibility is enhanced, when OCT is used.Accurate and objective methods of detecting disc and RNFL abnormalities, and their progression, would facilitate the diagnosis and monitoring of glaucomatous optic neuropathy [7].

RNFL thickness-

Superior RNFL thickness in suspects was found to be 106.33±7.09 and in POAG was found to be 78.93±26.2 (P value <0.001)
Inferior RNFL thickness in suspects was found to be 99.53±8.74 and in POAG was found to be 76.90±30.27 (P value 0.021)
Temporal RNFL thickness in suspects was found to be 60.63±12.03 and in POAG was found to be 48.07±14.16. (P value <0.001)
Nasal RNFL thickness in suspects was found to be 68.4±13.72 and in POAG was found to be 59.40±15.50 (P value <0.001).
Average RNFL thickness in suspects was found to be 83.51±2.83 and in POAG was found to be 66.81±13.51 (p value <0.001).

Christopher Bowd et al, analysed results of 30 normal, 30 ocular hypertensive and 30 glaucoma patients [8]. Mean RNFL was significantly thinner in ocular hypertensive eyes than normal eyes, 72.8µ (66.4 to 78.1) and 85.8µ(80.2 to 91.7) respectively. More specifically, RNFL was significantly thinner in ocular hypertensive eyes than in normal eyes in inferior quadrant. 84.8µ (75.6 to 94.0) versus 107.6µ(99.3 to 115.9). It is possible that thinner RNFL in the inferior quadrant of ocular hypertensive eyes is an early form of glaucoma that precedes detectable optic nerve and VF defects. RNFL was significantly thinner in glaucoma eyes than in ocular hypertensive eyes and normal eyes throughout 360 degrees and in all quadrants.

Conclusion

In Glaucoma suspect, the RNFL thickness and optic disc parameters were moderately correlated. In glaucoma suspects, RNFL thinning was presentwith minimal or no visual field sensitivity loss. Comparison of optic disc parameters between POAG and suspects, showed Horizontal Integrated rim width, rim area and cup disc ratio parameters to be statistically significant ($P<0.05$). The other parameters were not statistically significant. In POAG group, the RNFL thickness and optic disc parameters were well correlated with visual field changes OCT is capable of detecting changes at the level of RNFL in Glaucoma suspects with normal appearing discs and visual fields. OCT has been shown to obtain accurate and reproducible RNFL and retinal thickness measurement. OCT has shown to have greater diagnostic accuracy in RNFL measurements. Hence OCT can serve as a useful guideline in diagnosis, management, prognostication and research in Glaucoma.

References

[1]. Yanoff M, Duker JS. "Ophthalmology". 2nd ed. Printed in United Kingdom; Copyright ©Mosby International Ltd: 2004. P 1482-1486.
[2]. Lan YW, Henson DB, Kwartz AJ. The correlation between Optic nerve head topographic measurements, peripapillary nerve fiber layer thickness, and visual field indices in Glaucoma. Br J Ophthalmol 2003; 87:1135-1141.
[3]. Bhadauria M, Vata DR, Banarji A, Gurunadh VS, Patyal S, Nagpal S. AIOC 2009.
[4]. Min KH, Seong GJ, Hong YJ, Kim cy. Optic nerve head Topographic measurements and Retinal nerve fiber layer thickness in physiologic large cups. Korean Journal of Ophthalmology 2005; 19(3):189-194.
[5]. Pablo E, Ferreras A, Larrosa JM, Puey OV, Honrubia F. Diagnostic ability of Stratus Optical Coherence Tomography in Pre-perimetric Glaucoma diagnosis. Arch Soc ESP Ophthalmol 2006; 81:537-544.
[6]. Li G, Fansi AK, Boivin JF, Joseph L, Harasymowycz P. Screening for Glaucoma in high risk population using Optical Coherence Tomography. American Academy of Ophthalmology 2010;117: 453-461.
[7]. Subbiah S, Sankarnarayana S, Thomas PA, Jesudasan CA. Comparative evaluation of Optical Coherence Tomography in Glaucomatous, Ocular Hypertensive and normal eyes. Arch Ophthalmol. 2000:118:22-25.
[8]. Bowd C, Weinreb RN, Williams JM, Zangwill LM. The Retinal nerve fiber layer thickness in Ocular Hypertensive, normal, and Glaucomatous eyes with Optica; Coherence Tomography:. Arch Ophthalmol. 2008; 118:22-25

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