

CORRELATION BETWEEN STRUCTURAL RETINAL NERVE FIBRE LAYER THICKNESS AND FUNCTIONAL VISUAL FIELD LOSS IN PRIMARY OPEN ANGLE GLAUCOMA

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Background: Glaucoma is characterized by progressive degeneration of retinal ganglion cells and their axons that leads to nerve fiber layer loss, optic disc cupping, and consecutive glaucomatous visual field changes. Study is done in Department of ophthalmology, S.V.R.R Government General Hospital, S.V.Medical College Tirupati. A total of 52 eyes of 29 patients were included in the study. Mean age of the patients included in the study is 64.14+/- 11.43 years. Majority were male patients (68.96%). Female patients were only 31.04%.

Keywords: Retinal; Nerve; Fibre, Primary; Open; Angle Glaucoma

INTRODUCTION

Glaucoma is a significant global health problem. Glaucoma is second only to cataracts as a cause of blindness worldwide.¹ It is estimated that there will be 79.6 million glaucoma patients by the year of 2020 and of these, 74% will have Open Angle Glaucoma². Retinal nerve fiber layer (RNFL) loss is considered an early sign of glaucoma.³ Recent advances in imaging technologies using the optical properties of the RNFL allow objective and quantitative assessment of the RNFL thickness.³⁻⁵ Optical coherence tomography (OCT) is a noninvasive, noncontact technique for imaging the layered structure of the retina.^{6,7}

It is well known that perimeters detect visual field defects only after at least 30% of retinal nerve fibres have undergone damage. More over, Automated Perimetry is a subjective test and is dependant on the patients co-operation.

Optical coherence tomography (OCT), based on low-coherence interferometry helps in pre-perimetric diagnosis of glaucoma and is independent of the patient factors.

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MATERIAL AND METHODS

This is a cross sectional study done in Department of ophthalmology, S. V. R. R Government General Hospital, S. V. Medical College Tirupati from January 2013 to December 2013. The aim of this study is to correlate the structural changes in OCT with functional visual field defects.

Inclusion criteria for the subject of this research was all patients diagnosed cases of Primary Open angle Glaucoma. Exclusion criteria of this study were angle closure glaucoma, secondary glaucomas, other diseases affecting visual field. E.g., pituitary lesions, demyelinating diseases, Neurological causes, AIDS. Patients on medications known to affect visual field sensitivity. e.g. Chloroquine.

Data were collected on standardized proforma from all the subjects who were willing to participate in the study. Subjects underwent a complete ophthalmic examination including slit lamp examination, IOP measurement using applanation tonometer, 4 mirror gonioscopy, detailed stereoscopic fundus examination, pachymetry, after a detailed history taking.

Automated visual field testing was done in all subjects using Humphrey Field Analyser-2, Carl Zeiss Meditec using the central 24-2 threshold program and also by 10-2 threshold program in patients with central 6 degree visual field loss. Retinal Sensitivity of Superior and Inferior hemifield of a 24-2 print out is calculated and

Mean Deviation, Pattern Standard Deviation are noted.

Spectral Domain OCT Optovue Software version #6,1,0,4, was employed to determine RNFL analysis.

Statistical analyses were carried out with SPSS (Version 16.0; SPSS, Chicago). Pearson's linear regression analysis was used to correlate the retinal sensitivity of both the hemifields on Humphrey's automated perimetry with the average retinal nerve fibre layer thickness in Optical Coherence Tomography of the both quadrants respectively.

Pearson correlation coefficients with absolute values equal to or greater than 0.5 suggesting a strong association with $p < 0.01$ were accepted as statistically significant.

Regression analysis between RNFL and average retinal sensitivity of superior and inferior hemifields was performed, employing linear and curvilinear (quadratic) models with corresponding scatterplots showing best-fit regression curves and regression coefficients.

RESULTS

A total of 52 eyes from 29 patients were included in this study. Mean age of patients included was 64.14 ± 11.43 years. Majority were male (68.96%) and female were only 31.04%.

Linear regression analysis of average mean deviation of visual field examination and average RNFL thickness of OCT RNFL Analysis examination of all 52 eyes was determined by plotting mean deviation of visual field and average RNFL thickness. The plot was presented in Figure 1.

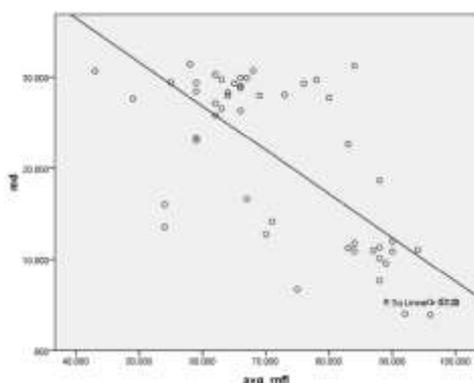


Figure 1

Plot of linear regression of mean deviation of visual field examination and average RNFL thickness of OCT RNFL for all patients

Linear regression analysis of pattern standard deviation of visual field examination and average RNFL thickness of OCT RNFL for examination of all 52 eyes was performed based on plot of these

two parameters. The regression results was presented in Figure 2.

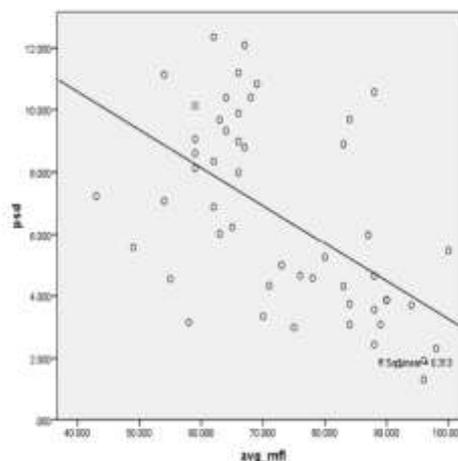


Figure 2

Plot of linear regression of standard deviation of visual field analysis and average RNFL thickness for all 52 eyes.

Linear Regression Analysis of superior hemifield retinal sensitivity of visual field examination and inferior RNFL thickness of OCT RNFL analysis examination for all 52 eyes was performed by plotting these two parameters. The result was presented in Figure 3.

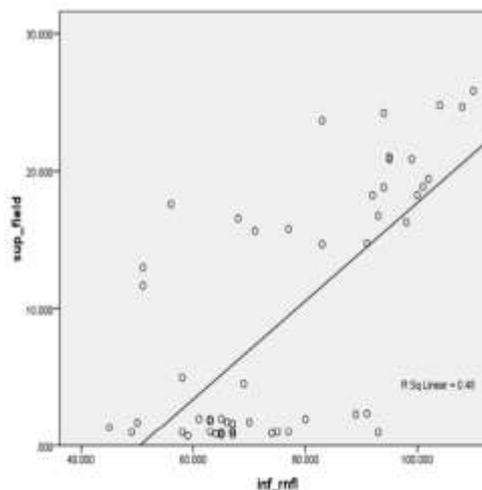


Figure 3

Plot of average superior hemifield retinal sensitivity and average inferior RNFL thickness on for all 52 eyes.

Linear Regression analysis of inferior hemifield retinal sensitivity of visual field examination and Superior RNFL thickness of OCT RNFL analysis examination for of all 52 eyes was performed by plotting these two parameters. The plot was presented in Figure 4.

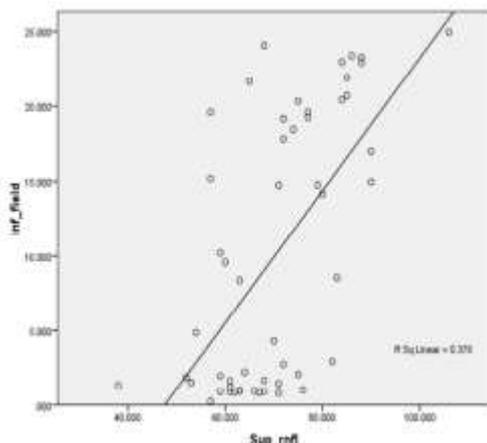


Figure 4

Graph of average inferior hemifield retinal sensitivity and average superior RNFL thickness on for all 52 eyes.

Correlation between average retinal sensitivity of superior and inferior hemifield in visual field and average RNFL thickness of superior and inferior hemisphere in OCT by Pearson's correlation coefficient was listed in Table 1.

Table 1
Summary of Pearson's Correlation

Parameters	RNFL Superior hemisphere Average	RNFL Inferior hemisphere Average
	r value (p value)	r value (p value)
Mean Superior visual field sensitivity	0.628 (0.000)	0.693 (0.000)
Mean Inferior visual field sensitivity	0.613 (0.000)	0.627 (0.000)

r = correlation coefficient.

DISCUSSION

As can be seen from Figure 1, increase in mean deviation will be followed by a decrease in average RNFL thickness. The correlation coefficient $r = -0.725$ and it was significant statistically.

Figure 2 reveals plotting pattern of standard deviation of Visual Field Analysis on Y-axis and Average RNFL thickness on X-axis of all 52 eyes. There is a negative correlation of mean PSD with average RNFL thickness. The correlation coefficient $r = -0.559$ and it was significant statistically.

Figure 3 shows plotting of average Superior hemifield retinal sensitivity on Y-axis and average inferior RNFL thickness on X-axis of all 52 eyes. Decrease of average superior hemifield retinal sensitivity was followed by a decrease in average RNFL thickness. The correlation coefficient $r = 0.6931$ and it was significant statistically.

Figure 4 reveals plotting of average inferior hemifield retinal sensitivity on Y-axis and average superior RNFL thickness on X-axis of all 52 eyes. Decrease of average inferior hemifield retinal sensitivity was followed by a decrease in average RNFL thickness. The correlation coefficient $r = 0.6128$ and it was significant statistically.

Table 1 shows correlation between average retinal sensitivity of superior and inferior hemifield in visual field and average RNFL thickness of superior and inferior hemisphere in OCT by Pearson's correlation coefficient

A positive correlation was noted with high statistical significance between average hemifield sensitivity of the visual field analysis and average RNFL thickness of OCT in the present study. Similar correlation was found in the study conducted by Reena Machanda Choudry et al.

Based on the result of this study, there is a direct correlation between the visual field loss in automated perimetry and the RNFL loss in OCT. Therefore OCT can be considered for monitoring the progression of glaucoma.⁸⁻¹¹

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