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ASSOCIATION OF RETINAL NERVE FIBRE LAYER THICKNESS WITH VISUAL FIELD CHANGES IN PATIENTS WITH PRIMARY OPEN ANGLE GLAUCOMA

Ophthalomology

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ABSTRACT

Background: Glaucoma is a chronic optic neuropathy marked by retinal ganglion cell loss, optic nerve cupping, and retinal nerve fibre layer (RNFL) thinning. Although perimetry has been the standard tool for glaucoma diagnosis, OCT enables earlier detection by identifying RNFL changes. Hence, it is instrumental in diagnosing pre-perimetric changes & monitoring disease progression. **Methods & Materials:** The study carried out on 110 patients diagnosed with POAG. VF testing by perimetry & staging of glaucoma was carried out. Zeiss OCT was used to analyse the thickness of RNFL. VF Variations with RNFL Thickness was then associated. **Statistical Analysis:** The results were noted and analysed by SPSS version. **Results:** There was male dominance(58.2%).As per perimetry grading; mild, moderate & severe glaucoma was reported among 50%, 40% & 10% of subjects respectively. Mean RNFL thickness (Right Eye) among subjects with mild, moderate & severe glaucoma was 77.95±7.46, 72.21±7.70 & 54.46±7.97 respectively and in Left Eye was 79.73±7.84, 73.32±12.08 & 54.72±10.92 respectively indicating an inverse relationship between RNFL thickness & glaucoma severity. **Conclusion:** OCT reliably measures RNFL thickness & shows strong correlation with VF changes in POAG. It can detect RNFL defects even before optic disc & visual field changes appear. Therefore, it is valuable for glaucoma diagnosis, its progression and treatment planning.

KEYWORDS

POAG, OCT, VF, RNFL

INTRODUCTION

Glaucoma, a progressive disease of optic nerve is marked by the retinal ganglion cell degeneration causing structural damage. Clinically, it presents as retinal nerve fibre layer (RNFL) thinning, neuroretinal rim loss and visual field(VF) abnormalities.[1] Primary open angle glaucoma (POAG) is defined as open angles (360 °) and raised intraocular pressure (IOP> 21mmhg) with glaucomatous damage.[2]

Approximately 57.5 million individuals across the globe are affected by POAG, representing 2.2% of global prevalence. [3] In North India, glaucoma ranked fourth for bilateral blindness with a 3.2% prevalence according to the National Blindness Survey.[4]

For POAG, important risk factors include high IOP, reduced central corneal thickness, myopia, older age, family history, cardiovascular conditions, vasculopathies, & diabetes.[5]

Since glaucoma remains asymptomatic in its initial stages, identification & assessment of risk factors are essential. Although Standard automated perimetry (SAP) is considered gold standard for detecting visual field loss,[6] early detection is vital as any structural damage to optic disc or RNFL is irreversible. Amongst the advanced diagnostic methods for RNFL measurements, Optical Coherence Tomography (OCT) has emerged as one of the most effective tools for early glaucoma detection. Its widespread accessibility, coupled with the fact that its non-invasive and relatively simple to perform, makes it valuable in clinical practice. Hence it is instrumental in diagnosing early-stage POAG & monitoring disease progression, supporting more effective use of anti-glaucoma therapies.[7]

SUBJECTS AND METHODS

The current "observational cross-sectional" study was conducted on patients diagnosed with POAG that presented to the "Outpatient Department of Ophthalmology" in a tertiary care hospital in western U.P. 110 POAG patients with age above 18 years applying inclusion & exclusion criteria took part in the study.

Inclusion Criteria:

1. Patients above the age of 18 years of either gender willing to participate in the research

2. Both new & old cases of POAG were diagnosed.

Exclusion Criteria:

1. History of diabetes mellitus, retinal laser damage, myopic retinal degeneration, that might affect VF or retinal thickness.
2. Any ocular abnormality such as corneal opacities, mature cataracts, congenital glaucoma, primary angle closure glaucoma, secondary glaucoma & Optic Atrophy.
3. History of any Intraocular surgery less than, refractive or retinal surgery in the past 6 weeks.
4. Patients with unreliable visual fields or those with hearing impairment, mental retardation, speech disorder, or psychiatric ailments.
5. Visual acuity less than 6/36.

METHODOLOGY

After receiving approval from the Institutional Ethics Committee & College Research Committee, this study was carried out. The trial covered all individuals with POAG who were older than 18 & met the inclusion & exclusion criteria. A thorough eye examination was performed on all patients who arrive at the Out Patient Department of Ophthalmology with elevated IOP & glaucomatous alterations. VA, BCVA, slit-lamp, dilated fundus examination, & gonioscopy were all included in the ocular examination. Using the Humphrey Field Analyser for visual field testing & staging of glaucoma by Hodapp, Parrish, & Anderson criteria was carried out. Zeiss OCT was used to analyse the thickness of the RNFL. Information was gathered in accordance with the proforma & input into an Excel document. Visual Field Variations with Retinal Nerve Fibre Layer Thickness was then associated. Appropriate statistical tests were applied.

VF Grading: According to Hodapp, Parrish and Anderson criteria visual field of MDs with >6 dB, <12 dB and >12 dB were classified as mild, moderate and severe glaucoma, respectively.

Analytical Statistics: Descriptive statistics: All quantitative variables were expressed using the mean +/- standard deviation, whereas qualitative aspects were expressed using frequency & percentage.

Inferential Statistics: When analysing the data, the proper statistical test was used.

RESULTS

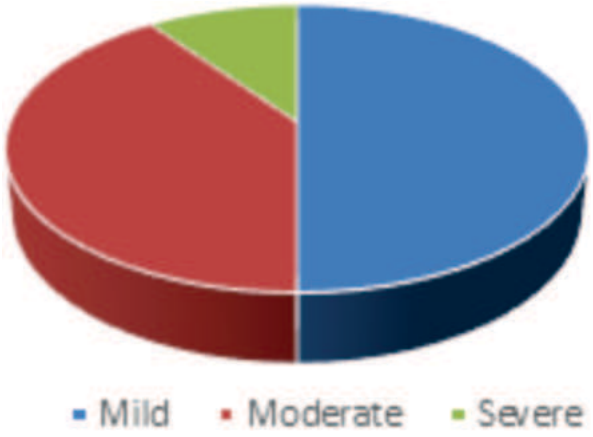
Male & female comprised of 58.2% & 41.8% of the subjects

respectively. Hence there was male dominance in this study. The age group of 51–60 years old accounted for largest percentage (26.36%), followed by 31–40 years old (22.73%). The minimum percentage of individuals (10%) were between the ages of 21 & 30.

Mean IOP of right and left eye among the study subjects was 18.03±4.91 and 18.42±5.26, respectively with minimum & maximum of 10 & 36 respectively. Most of the subjects had C:D of 0.7:1 followed by 0.6:1. As per perimetry grading; mild, moderate & severe glaucoma was reported among 50%, 40% & 10% of subjects respectively (table 1; graph 1).

Table 1: Perimetry Grading

Grading	N	%
Mild	55	50.0
Moderate	44	40.0
Severe	11	10.0
Total	110	100



Graph 1: Perimetry Grading

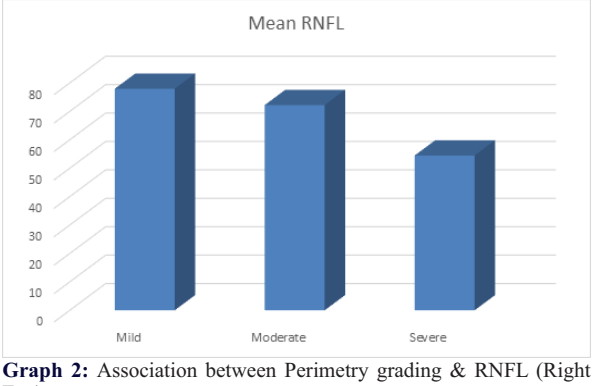
Mean RNFL thickness (Right Eye) among the study subjects was 73.70±10.42 with minimum & maximum of 43 & 101 respectively (table 2; graph 2). Mean RNFL thickness (Left Eye) among the study subjects was 75.04±12.46 with minimum & maximum of 27 & 98 respectively.

Mean RNFL thickness (Right Eye) among subjects with mild, moderate & severe glaucoma was 77.95±7.46, 72.21±7.70 & 54.46±7.97 respectively. Hence RNFL thickness decreases with increase in severity of glaucoma. When RNFL thickness was compared according to severity of glaucoma, significant difference was found as p<0.05 (table 2; graph 2).

Table 2: Association Between Perimetry Grading & RNFL (Right Eye)

Grading	Mean RNFL	SD
Mild	77.95	7.46
Moderate	72.21	7.70
Severe	54.46	7.97
p value	<0.01*	

*: statistically significant



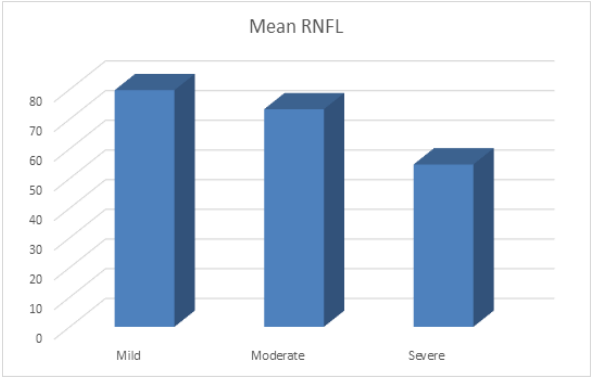
Graph 2: Association between Perimetry grading & RNFL (Right Eye)

Mean RNFL thickness (Left Eye) among subjects with mild, moderate & severe glaucoma was 79.73±7.84, 73.32±12.08 & 54.72±10.92 respectively. Hence RNFL thickness decreases with increase in severity of glaucoma. When RNFL thickness was compared according to severity of glaucoma, significant difference was found as p<0.05 (table 3; graph 3).

Table 3: Association Between Perimetry Grading & RNFL (Left Eye)

Grading	Mean RNFL	SD
Mild	79.73	7.84
Moderate	73.32	12.08
Severe	54.72	10.92
p value	<0.01*	

*: statistically significant



Graph 3: Association between Perimetry grading & RNFL (Left Eye)

DISCUSSION

POAG remains a leading yet preventable causes of blindness worldwide. The pathological process of POAG primarily involves decline in retinal ganglion cells which is estimated at 25–30%-can occur prior to detectable visual field abnormalities, the term "pre-perimetric glaucoma" is used to describe this early stage.

OCT, a non-invasive, contactless imaging technique enables quantifying RNFL thickness. It serves as a valuable tool for detecting & monitoring RNFL damage & assessing its progression over time. Purpose of this research was "to associate changes in the visual field & the thickness of RNFL in patients with POAG."

In this study, 41.8% of participants were female & 58.2% were male, indicating a predominance of male subjects. However, other studies, including those by Preeti Chopra et al.[8] & C. S. Sandhya et al.,[9] reported a female predominance among glaucoma patients, which differs from the current findings.

Based on perimetry grading, 50% of the subjects had mild glaucoma, 40% moderate, & 10% severe. The mean RNFL thickness (Right Eye) among patients with mild, moderate, & severe glaucoma was 77.95 ± 7.46 µm, 72.21 ± 7.70 µm, & 54.46 ± 7.97 µm, respectively. This indicates a clear inverse relationship between RNFL thickness & glaucoma severity, with a statistically significant difference observed across severity levels ($p < 0.05$). These findings are supported by Latha C et al.,[11] who reported an average RNFL thickness of 83.51 ± 2.83 µm in glaucoma suspects & 66.81 ± 13.51 µm in patients with POAG ($p < 0.001$). Ahmed E. Abd El-Naby et al., [12] examined RNFL thickness across various glaucoma stages & observed a progressive decline similar to the trend noted in the current study.

CONCLUSION

It is well established that RNFL thickness & optic disc properties in the POAG group were strongly correlated with changes in the visual field. Additionally, OCT is recognized as a reliable and accurate method for detecting RNFL abnormalities, even in cases where optic disc and visual field appear normal. Therefore, it has proven to serve as a useful guide for early glaucoma diagnosis and management.

The novel finding in this study is the observation of a male predominance among POAG patients which may have implications for understanding disease risk factors and tailoring screening strategies in specific populations.

REFERENCES

1. Mishra D, Singh K, Bhushan P, Kaur K, Gurnani B, Singh A, et al. Assessment of optic disk by disk damage likelihood scale staging using slit-lamp biomicroscopy and optical coherence tomography in diagnosing primary open-angle glaucoma. Indian Journal of Ophthalmology. 2022;70(12):4152.
2. Seth, Praveen Kumar; Senthil, Sirisha; Das, Anthony Vipin; Garudadri, Chandrasekar. Prevalence of glaucoma types, clinical profile and disease severity at presentation: Tertiary Institute based cross-sectional study from South India. Indian Journal of Ophthalmology 71(10):p 3305-3312, October 2023.
3. Genetics of glaucoma. Wiggs JL, Pasquale LR. Hum Mol Genet. 2017;26:0.
4. Vashist P, Senjam SS, Gupta V, Gupta N, Shamanna BR, Wadhwani M, et al. Blindness and visual impairment and their causes in India: Results of a nationally representative survey. PLoS One. 2022; 17(7): e0271736.
5. Maurya RP. Biomarkers of primary open-angle glaucoma. Indian J Clin Exp Ophthalmol. 2017;3(1):1.
6. Gedde SJ, Chen PP, Muir KW, Vinod K, Lind JT, Wright MM, et al. Primary Angle-Closure Disease Preferred Practice Pattern®. Ophthalmology. 2020 Nov.
7. Hood DC, La Bruna S, Tsamis E, Thakoor KA, Rai A, Leshno A, et al. Detecting glaucoma with only OCT: Implications for the clinic, research, screening, and AI development. Progress in Retinal and Eye Research. 2022 Sep;90:101052.
8. Chopra P, Gupta M, Gupta S. Evaluation of Correlation among Retinal Nerve Fiber Layer Thickness, Cup Disc Ratio and Perimetric Indices in Primary Open Angle Glaucoma and Glaucoma Suspects. International Journal of Science and Research (IJSR) 2021; 10(8): 579-84.
9. Sandhya CS, Nookala GPD, Karimoon T, Harris T A. Comparison of visual fields and retinal nerve fiber layer thickness in assessing optic nerve head damage in patients with primary open-angle glaucoma. Indian J Clin Exp Ophthalmol 2022; 8(2): 210-216.
10. Chinmayeepabolu K, Kirtinath J, Rajalakshmi AR, Swathi N. Analysis of Retinal Nerve Fiber Layer and Optic Nerve Head by Optical Coherence Tomography in POAG. Int J Anat. 2016; 5(2): 11–3.
11. Latha C. 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 (Doctoral dissertation, Rajiv Gandhi University of Health Sciences (India)). Medpulse 2019; 9(1): 1-3.
12. El-Naby AE, Hossam Y, Abouelkheir, Hossam T, Al-Sharkawy TH, Mokbel. Correlation of retinal nerve fibre layer thickness and perimetric changes in primary open-angle glaucoma. Journal of the Egyptian Ophthalmological Society. 2018; 111: 7–14.