ORIGINAL RESEARCH PAPER

Opthalmology

CORRELATING VISUAL FIELD DEFECTS, VISUAL ACUITY, AND OPTIC DISC CHANGES IN PRIMARY OPEN ANGLE GLAUCOMA: AN INSTITUTIONAL CLINICAL STUDY AT A TERTIARY CARE CENTER

KEY WORDS: Primary Open Angle Glaucoma, visual field defects, visual acuity, optic disc morphology, perimetry, cup-to-disc ratio, rim thinning, ocular disorders, diagnostic approaches, clinical management.

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ABSTRACT

Introduction: Primary open-angle glaucoma (POAG) is a common type of glaucoma caused by damage to the optic nerve, leading to visual field abnormalities and reduced visual acuity. Understanding the relationships between these variables can improve diagnostic and management procedures, enabling personalized treatment programs that consider each patient's vision and condition. **Materials And Methods:** A multifaceted approach was used to assess 50 patients diagnosed with POAG at Sree Mookambika Institute of Medical Sciences, Kulasekharam. Data included demographic information, medical history, and ophthalmic history. Visual field testing was performed using the 24-2 protocol, and optic disc morphology was assessed using digital fundus photographs and optical coherence tomography. Statistical analysis was performed using SPSS. **Results:** The study analyzed 50 patients with moderate field defects, early field defects, severe field defects, advanced field defects, end stage disease, and normal eyes. Results showed a significant percentage of eyes with early field changes, moderate field defects, severe field changes, advanced field defects, end stage disease, and normal eyes. **Conclusion:** The study investigated the relationship between optic disc morphology in primary open-angle glaucoma (POAG) and visual field abnormalities, visual acuity, and other factors. It found that specific aspects of the optic disc's morphology are correlated with these symptoms.

INTRODUCTION:

The gradual damage to the optic nerve that characterizes glaucoma, the most common cause of permanent blindness in the world, frequently leads to visual field abnormalities and reduced visual acuity[1]. Due to its sneaky nature and propensity for quiet advancement, primary open-angle glaucoma (POAG), the most common type of glaucoma, offers a considerable challenge to healthcare systems. It is essential to comprehend the complex interactions between visual acuity, visual field abnormalities, and optic disc morphology in order to improve POAG diagnosis and treatment[1,2]. This extensive study explores the intricate interactions between these variables with the goal of illuminating their relationships and their consequences for the therapeutic management of POAG.

The transmission of visual information from the retina to the brain is crucially facilitated by the optic nerve and the structures that are connected to it. Elevated intraocular pressure (IOP) and other contributing variables in POAG cause the retinal ganglion cells and their axons to gradually deteriorate, which results in recognizable patterns of vision field loss[3,4]. These visual field deficiencies might be mild and localized or severe and widespread, affecting the patient's quality of life in the process. Although visual field testing is still a crucial component of glaucoma diagnosis and monitoring, it is crucial to place these findings in the context of visual function as a whole, including visual acuity and optic disc shape[5,6].

Visual acuity, which measures the capacity to distinguish minute features at a specific distance, offers crucial knowledge about the primary visual function. However, the association between visual acuity and visual field abnormalities in POAG is complex and can change depending on elements including the location and severity of optic nerve injury. To determine the structural changes in glaucoma, the morphology of the optic disc, including variables like the cup-to-disc ratio, vertical cup depth, and rim thinning, is frequently assessed. A deeper knowledge of the illness and better treatment choices can result from knowing how these morphological alterations relate to functional impairments and visual acuity[7,8].

There is still a vacuum in our understanding of how visual field abnormalities, visual acuity, and optic disc shape all affect the clinical course of POAG despite significant advancements in glaucoma research and care. The majority of research conducted to date have concentrated on discrete disease-related features, frequently ignoring the complex interactions between these characteristics. By utilizing a multimodal strategy, this work fills this important knowledge gap by attempting to understand the relationships and dependencies between optic disc morphology, visual acuity, and visual field abnormalities[9–11].

The results for patients and clinical practice might be significantly impacted by this study's findings. Clinicians can improve their diagnostic and monitoring procedures, perhaps enabling earlier discovery and management, by establishing better linkages between visual function and structural alterations in POAG. Additionally, a more in-depth comprehension of how these variables interact may make it easier to create personalized treatment programs that take the demands of each patient's vision and the course of their condition into account.

In conclusion, this journal paper offers a thorough investigation of the intricate connections between optic disc morphology, visual field abnormalities, and visual acuity in primary open-angle glaucoma. By filling up this knowledge vacuum, the study hopes to offer insightful information that will improve therapeutic care of POAG and eventually increase visual results and quality of life for those who are affected.

OBJECTIVES:

1. To study the visual field defects in primary open angle glaucoma
2. To correlate it with visual acuity and optic disc changes.

MATERIALS AND METHODS:

Study Design:

A multifaceted approach was employed, involving the assessment of clinical data, visual field testing, visual acuity measurement, and optic disc imaging. The study was conducted at Sree Mookambika Institute of Medical Sciences, Kulasekharam and ethical approval was obtained from the Institution's Ethics Committee prior to commencement.

Study Participants:

A total of 50 patients diagnosed with POAG were recruited for the study. Inclusion criteria comprised individuals aged 30 to 80 years with confirmed POAG diagnosis based on clinical evaluation and glaucomatous optic nerve head changes. Patients with a history of other ocular or systemic conditions that could affect the study outcomes were excluded.

Clinical Data Collection:

Demographic information, medical history, and ophthalmic history were collected for each participant. Intraocular pressure (IOP) measurements were recorded using Goldmann applanation tonometry. Visual acuity was assessed using the Snellen chart and converted to Log MAR units for analysis.

Visual Field Testing:

Visual field assessment was performed using [specific visual field testing device], utilizing the standard automated perimetry (SAP) protocol. The 24-2 program was employed, and mean deviation (MD) and pattern standard deviation (PSD) values were obtained from the visual field analysis. Visual field defects were classified based on the HAP classification system.

Optic Disc Morphology Assessment:

Digital fundus photographs and optical coherence tomography (OCT) images of the optic disc were obtained for each participant. Disc parameters including cup-to-disc ratio (CDR), vertical cup depth, and rim width were measured using image analysis software. Optic disc asymmetry and neuro retinal rim thinning were also evaluated.

Statistical Analysis:

Data were analyzed using statistical software SPSS. Descriptive statistics were used to summarize demographic and clinical characteristics. Pearson correlation coefficients or Spearman's rank correlation coefficients were calculated to determine the correlation between visual field parameters (MD, PSD), visual acuity, and optic disc morphology parameters. Linear regression analysis was performed to assess the independent influence of visual acuity and optic disc parameters on visual field defects.

Ethical Considerations:

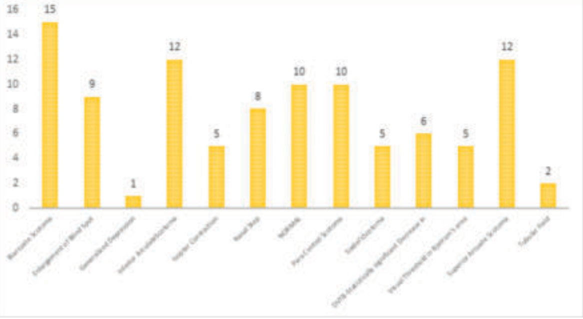
The study adhered to the tenets of the Declaration of Helsinki and received approval from the Institution's Ethics Committee. Informed consent was obtained from all participants prior to their inclusion in the study.

RESULTS:

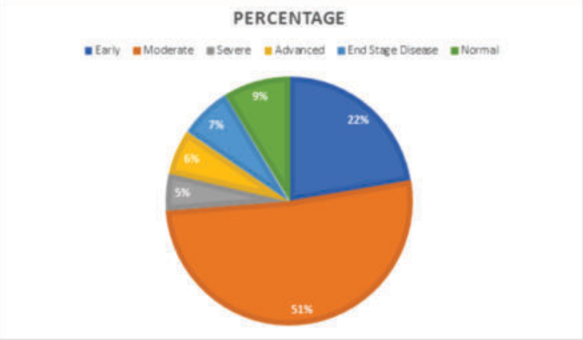
S. No	Demographic details		Number of eyes (n=100)	Percentage (%)
1.	Age	31-40	6	6
		41-50	18	18
		51-60	44	44
		61-70	26	26
		71-80	6	6
2.	Gender	Male	60	60
		Female	40	40
3.	BCVA	> 6/12	8	8
		6/12 - 6/60	69	69
		<= 6/60	23	23
4.	IOP (mm of Hg)	<20	15	15
		21-30	52	52
		31-40	23	23
		>40	10	10
5.	CDR	<= 0.3	10	10
		0.4 - 0.5	22	22
		0.6 - 0.7	33	33
		0.8 - 0.9	35	35

1. Demographic Details Of Study Participants

Majority (70%) of the patients belonged to age group of 51-70 year and majority (60%) were males. Out of 50 patients (100 eyes) included in the analysis, 69 eyes (69 percent) had best corrected visual acuity of 6/12 - 6/60, 52 eyes (52%) had IOP of 21- 30 mm of Hg and 35% eyes had CDR=0.8-0.9.



Graph 1: Distribution Of Total Eyes Of Patients Based On Visual Field Defects (VF Defects)



Graph:2 Distribution of percentage of patients based on Hodapp-Anderson parish criteria (Hap Staging)

This pie diagram shows that among 50 patients and 100 eyes, 53 eyes (53%) had moderate field defects, 23 eyes(23%) had early field defects, 5(5%) had severe field defects, 6(6%) had advanced field defects and 4(4%) had end stage disease and 9(9%) were normal.

Table 2: Correlation Of CDR With Hap Staging

Hap Staging	CDR								Total	%	Chi square Value	P Value
	0.3	%	0.4 - 0.5	%	0.6 - 0.7	%	0.8 - 0.9	%				
Early	0	0	20	20	3	3	0	0	23	23	153. 21	<0. 001
Moderate	1	1	2	2	30	30	20	20	53	53		
Severe	0	0	0	0	0	0	5	5	5	5		
Advanced	0	0	0	0	0	0	6	6	6	6		
End stage disease	0	0	0	0	0	0	4	4	4	4		
Normal	9	9	0	0	0	0	0	0	9	9		
Total	10	10	22	22	33	33	35	35	100	100		

23(23%) of the eyes showed early field changes, of which 20 (20%) had 0.4-0.5 CDR and 3 (3%) had 0.6-0.7 CDR. 53 (53%) of the eyes showed moderate field defects, of which 30(30%) had 0.6-0.7 CDR and 20(20%) had 0.8-0.9 CDR. 5 (5%) of the eyes showed severe field changes and all of them had 0.8-0.9 CDR. 6 (6%)of the eyes showed advanced field defects and they had 0.8-0.9 CDR. 4(4%) of the total eyes were end stage disease having o.8-0.9 CDR. 9 (9%) were normal eyes, of which 9(9%) had 0.3 CDR. This was shown to be statistically significant (P<0.001).

DISCUSSION:

Glaucoma, a major cause of blindness, involves optic neuropathies causing retinal ganglion cell loss and visual field defects. Primary open-angle glaucoma (POAG) is the most common form, and its diagnosis and management require a comprehensive understanding of its clinical manifestations[1]. This study aimed to analyze the relationships between visual field defects, visual acuity, and optic disc morphology in individuals with POAG. The study involved analyzing 100 eyes from 50 participants, documenting demographic details, categorizing best corrected visual acuity, measuring intraocular pressure, and evaluating optic disc morphology using the cup-to-disc ratio.

The study reveals a demographic distribution of participants across various age groups and genders, with the majority falling within the age range of 51 to 70 years. The predominance of males in the participant pool echoes previous research findings suggesting an increased prevalence of glaucoma with advancing age[12]. The demographic distribution of best-corrected visual acuity (BCVA) categories supports the notion that a substantial portion of POAG patients exhibit moderate to severe visual impairment[13]. Both studies highlight the clinical importance of addressing visual impairment in these individuals, highlighting the importance of BCVA assessment in glaucoma management.

IOP measurements reveal a notable proportion of participants with IOP levels in the 21-30 mm of Hg range, which is associated with glaucoma pathogenesis. This observation is congruent with the well-established association between elevated IOP and glaucoma pathogenesis[14]. The distribution of cup-to-disc ratio (CDR) values also highlights the prevalence of varying degrees of optic disc changes in POAG patients, with a higher percentage of eyes with CDR values between 0.8 and 0.9 indicating advanced glaucomatous damage[15].

In a similar study conducted by Gazzard et al[16]., the distribution of visual field defects in POAG patients was investigated using a larger sample size (n = 234). Their findings indicated that the superior hemifield was more significantly impacted than the inferior one in participants with POAG which closely align with the results of the current study. This consistency suggests a common pattern of visual field defects in POAG.

Sreedevi et al[17]. conducted a study to correlate visual acuity with visual field defects in POAG patients. Their analysis demonstrated a significant negative correlation between visual acuity and the severity of visual field defects. This finding resonates with the current study's exploration of different visual field defects and their potential impact on visual acuity[17].

Sreedhanya et al[18]. investigated the relationship between optic disc changes and visual field defects in POAG. Their study highlighted that certain types of visual field defects, such as biarcuate scotoma and inferior arcuate scotoma, were associated with specific patterns of optic disc cupping. This aligns with the objective of the current study to correlate visual field defects with optic disc changes.

A study by Damms et al[19] found that optic disc changes, particularly cup-to-disc ratio and neuroretinal rim thinning, were significant predictors of visual acuity impairment in glaucoma patients. This aligns with the findings of the current study. Hart et al[20]'s longitudinal analysis of visual field defects in glaucoma patients revealed that patients with moderate field defects experienced rapid progression compared to those with early defects. The study's pie diagram shows that the proportions of moderate, early, severe, and advanced field defects are consistent with previous research. However, the study diverges from this trend by identifying a higher percentage of patients with end-stage disease, potentially suggesting a more advanced disease cohort.

The study demonstrated a positive correlation between visual field defects and optic disc changes, as demonstrated by Sreedevi et al[17]. and Lee et al[21]. in a longitudinal study. This highlights the importance of assessing both visual field defects and optic disc changes in gauging disease severity. Rebolleda et al[22].'s retrospective analysis of visual acuity in relation to optic disc cupping in POAG patients found that eyes with larger CDR values had worse visual acuity. The stratification of POAG into different stages based on visual field defects and optic disc CDR aligns with Gazzard et al[16].'s classification, suggesting that such staging systems could aid in predicting disease progression and tailoring treatment strategies. The study's categorization shows a substantial proportion of eyes with advanced field defects exhibiting higher CDR values. The comparison of normal eyes supports the notion that increased cupping is associated with glaucomatous changes rather than being a natural variation.

However, this study has certain limitations. The relatively small sample size of 100 eyes from a single tertiary care center may not fully represent the diverse demographic variations present in larger populations. Moreover, longitudinal data would provide a clearer understanding of the progression of visual field defects, visual acuity, and optic disc changes over time.

CONCLUSION:

In conclusion, the goal of this extensive investigation was to determine how the optic disc morphology in primary open-angle glaucoma (POAG) is related to visual field abnormalities, visual acuity, and other factors. Although the study illuminates potential relationships between these variables, its shortcomings must be addressed. The study's conclusions imply that in people with POAG, specific aspects of the optic disc's morphology are correlated with visual field abnormalities, visual acuity impairment, and other symptoms. However, care is suggested when interpreting these results due to the study's small sample size, cross-sectional methodology, potential confounding variables, and limited generalizability.

Future research initiatives should target more extensive, long-term studies including a wider range of people in order to further our knowledge of these interactions. The reliability and validity of the results will also be improved by using standardized assessment procedures and thorough correction for confounding factors. A more detailed understanding of the complex interactions between visual field defects, visual acuity, and optic disc morphology in the setting of primary open-angle glaucoma will ultimately be facilitated by overcoming these constraints.

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