Research

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Relationship Between Visual Field, Intraocular Pressure, and Retinal Nerve Fiber Layer in Patients with Open-Angle Glaucoma and Depression Level

Açık Açılı Glokom Hastalarında Görme Alanı, Göz İçi Basıncı ve Retina Sinir Lifi Tabakası ile Depresyon Düzeyi Arasındaki İlişki

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ABSTRACT

Objective: The aim of this study was to investigate the relationship between depression levels and parameters such as intraocular pressure variability, visual field scores, and retinal nerve fiber layer (RNFL) thickness in patients with primary open-angle glaucoma (POAG).

Method: A total of 50 patients diagnosed with POAG were included in this study. All participants underwent a comprehensive ophthalmological evaluation including intraocular pressure measurements and retinal nerve fiber layer (RNFL) thickness measurements using standard automated perimetry for visual field analysis and optical coherence tomography to assess the functional and structural damage caused by glaucoma. The Beck Depression Inventory (BDI) was administered to all participants to assess their depression levels.

Results: There were no significant relationship between BDI scores and intraocular pressure, visual field, retinal nerve fiber analysis, or number of medications used in glaucoma patients. In the multiple linear regression analysis, the model was found to be statistically significant (F=3.805) and explained 25.3% of the variance in BDI scores.

Conclusion: Patients with primary open-angle glaucoma exhibit mild depressive symptoms regardless of the severity of the disease's impact on the eye, and that the level of depressive symptoms increases with age. This finding suggests that the development of depression in glaucoma may be associated not only with objective parameters of the disease but also with age and other personal factors.

Keywords: Primary open-angle glaucoma, visual field, retinal nerve fiber analysis, depression

ÖZ

Amaç: Bu çalışmanın amacı, primer açık açılı glokom (PAAG) hastalarında göz içi basıncı düzensizliği, görme alanı skorları ve retina sinir lifi (RNFL) kalınlığı gibi parametrelerle depresyon düzeyi arasındaki ilişkinin incelenmesidir.

Yöntem: Bu çalışmaya PAAG tanısı almış toplam 50 hasta dahil edildi. Tüm katılımcılara kapsamlı oftalmolojik değerlendirme yapıldı. Bu kapsamda göz içi basıncı ölçümleri, glokomun fonksiyonel ve yapısal hasarını değerlendirmek amacıyla standart otomatik perimetri ve görme alanı analizi ile optik koherens tomografi kullanılarak RNFL kalınlık ölçümleri yapıldı. Depresyon düzeyleri Beck Depresyon Ölçeği (BDÖ) ile değerlendirildi.

Bulgular: Glokom hastalarında göz içi basıncı, görme alanı, retina sinir lifi analizi ve kullanılan ilaç sayısı ile BDÖ puanları arasında anlamlı ilişki saptanmamıştır. Çoklu doğrusal regresyon analizi model istatistiksel olarak anlamlı bulundu (F=3,805) ve BDÖ puanlarındaki varyansın %25,3'ünü açıklamıdı.

Sonuç: Primer açık açılı glokom hastalarının glokomun gözü etkileme şiddetinden bağımsız olarak hafif düzeyde depresif belirti gösterdiklerini, yaş arttıkça depresif belirti düzeylerinin arttığı saptanmıştır. Bu bulgu, glokomda depresyon gelişiminin yalnızca glokom hastalığının objektif parametreleriyle değil, yaş ve diğer kişisel faktörlerle de ilişkili olabileceğini göstermektedir.

Anahtar sözcükler: Primer açık açılı glokom, görme alanı, retina sinir lifi analizi, depresyon

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Introduction

Glaucoma is a progressive, chronic optic neuropathy characterized by loss of retinal ganglion cells and visual field defects. The most significant risk factor is elevated intraocular pressure. Generally, high intraocular pressure results from impaired outflow of the aqueous humor. Although glaucoma is among the most common causes of irreversible blindness, intraocular pressure can be controlled using medical and surgical methods (Jayaram et al. 2023, Asrani et al. 2024, Dietze et al. 2024). Primary open-angle glaucoma (POAG) is a progressive neurodegenerative disease characterized by damage to the optic nerve. POAG is a type of glaucoma in which the iridocorneal angle is anatomically open. Due to glaucomatous optic neuropathy that develops during the course of the disease, progressive and irreversible visual field losses occur, along with a decrease in visual acuity in advanced stages (Saccà et al. 2019, Rovelt et al. 2024, Wang et al. 2024). Increased cup depth or enlargement of the physiological cup, angulation and displacement of retinal vessels, changes in the color of the optic disc, and atrophy of the retinal nerve fiber layer with hemorrhage are typical clinical findings specific to glaucoma (Gupta 2024, Waisberg and Micieli 2024). In glaucoma, the diagnosis is based on measurements of elevated intraocular pressure, glaucomatous visual field defects, and optical coherence tomography (OCT), and follow-up can be conducted based on the progression observed in these tests (Chang and Singh 2019)

Glaucoma can cause both functional damage—manifested as visual field defects—and structural damage—resulting from changes in the optic nerve head (Ahmed et al. 2021). Once diagnosed, antiglaucoma medications are used to reduce the production of aqueous humor or increase its outflow, thereby lowering intraocular pressure (Schmidl et al. 2015). Today, the Goldman applanation tonometer is considered the most accurate device for measuring intraocular pressure. Normal intraocular pressure (IOP) typically ranges from 9 to 22 mmHg, although this value may vary depending on individual factors. In patients with glaucoma, the doctor sets a target intraocular pressure to prevent further damage to the optic nerve. This target IOP is determined based on the patient's specific condition and needs and may be lower than 22 mmHg (Xu et al. 2025). In glaucoma, visual field defects are assessed using visual field measurements that correspond to the anatomical arrangement of damaged nerve fibers at the optic nerve head (Chuangsuwanich et al. 2023). OCT is a transpupillary imaging method based on the principle of low-coherence interferometry; measurements of peripapillary or macular nerve fiber layer thickness are performed to detect glaucomatous retinal nerve fiber damage at an early stage (Zeppieri et al. 2023).

Glaucoma is a progressive disease that can negatively affect not only visual function but also patients' psychological, emotional, and social lives (Quaranta et al. 2016, Inayat et al. 2024). Depression and anxiety are among the most common mental health disorders observed in individuals with glaucoma (Giacometti et al. 2024). Neurodegeneration is thought to be one of the causes of depression (Filatova et al. 2021). Because the brain and retina develop from the same neuroectoderm and thus share similar structural and functional characteristics, neurodegenerative diseases are thought to be associated with depression (Pradhan and Das 2021). Adherence to treatment in chronic diseases influences the clinical course of the disease and is crucial in determining treatment success. The presence of psychiatric symptoms, however, can negatively affect both the prognosis of these diseases and adherence to treatment. For this reason, it is believed that assessing individuals for psychiatric symptoms during the follow-up process in diseases characterized by a chronic course and progressive vision loss would be beneficial for disease prognosis and quality of life (Fernandez-Lazaro et al. 2019).

Although the prevalence of depression and anxiety in patients with glaucoma has been frequently examined in the existing literature, the relationship between objective clinical parameters of glaucoma and psychiatric symptoms has not been sufficiently investigated. In particular, the relationship between measurable glaucoma progression parameters such as retinal nerve fiber layer thickness, visual field loss, and intraocular pressure and mental health has been addressed in only a limited number of studies. This creates a gap in understanding the role of psychological factors in glaucoma management. In this study, we aimed to investigate the relationship between patients' depression scores and variables such as disease severity as determined by measurements including intraocular pressure variability, functional visual field scores, and retinal nerve fiber layer analysis measured by OCT in patients with glaucoma. We

believed that by identifying the specific factors most strongly associated with depression in glaucoma a condition characterized by progressive vision loss we could provide appropriate psychosocial support to glaucoma patients. Our hypothesis is that objective parameters indicating glaucoma progression (retinal nerve fiber layer [RNFL] thickness, visual field loss, and intraocular pressure fluctuations) are significantly associated with the level of depression. The contribution of our study to the literature lies in its holistic evaluation not only of the effects of glaucoma on visual function but also of the relationship between objective ophthalmological findings and symptoms of mental health. In this way, it aims to provide scientific evidence to support the early identification of psychological symptoms in glaucoma patients and to guide clinicians in adopting a multidisciplinary approach to patient care.

Method

Sample

For this cross-sectional study, 60 individuals diagnosed with PAAG at the Ophthalmology Clinic of Elazığ Fethi Sekin City Hospital in 2024 were evaluated. The sample size was determined based on a study reporting differences in depression levels across stages of open-angle glaucoma (Cvetković et al., 2024) and Cohen's effect size classification (Cohen, 1988). Assuming a medium-to-large effect size (Cohen's f = 0.50) for a one-way ANOVA, the sample size was calculated using the G*Power 3.1 software. The minimum total sample size required for $\alpha = 0.05$ and 80% power was determined to be N = 42.

Procedure

This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval for the study was obtained from the Fırat University Ethics Committee for Non-Interventional Clinical Research (date: May 15, 2024; number: 24198).

Eye Examination and Ophthalmic Measurements

After evaluating the patients' demographic characteristics, the ophthalmologist assessed intraocular pressure, visual field, optic nerve head analysis, and the number of medications the patients were taking. Intraocular pressure was measured using the Goldman applanation tonometer (Optilasa SL, Madrid, Spain) after instilling anesthetic eye drops and applying fluorescein. Three visual field tests were performed using the Goldmann® Field Analyzer (Optopol PTS 2000, USA) GA device with the SITA 30-2 achromatic GA test, and the third test was included in the study. GA results with a fixation loss of ≤33% and a false positive/negative error rate of ≤20% were considered reliable and included in the study. The visual field functional score was calculated using the Functional Vision Calculation Module developed by the Turkish Ophthalmology Association (TOD). Changes in retinal nerve fiber layer thickness were recorded using a Canon OCT device (OCT HS 100—Canon Inc., Tokyo, Japan). The antiglaucoma medications the patient was taking and which specific medications were identified.

Psychiatric Evaluation

Psychiatrists then conducted structured interviews based on the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5), each lasting approximately 30 minutes. After obtaining signed written informed consent, all participants were administered the Sociodemographic and Clinical Data Form and the Beck Depression Inventory (BDI) by a mental health specialist.

The study included participants who were 18 years of age or older, had no known or past history of psychiatric disorders (including depression), were literate, had no chronic physical illnesses, had no chronic eye diseases other than glaucoma, had not previously undergone glaucoma surgery, and had no ocular barriers to OCT imaging or were able to undergo general anesthesia (GA) for the examination.

To prevent any potential confounding effects of the clinical symptoms associated with a diagnosis of major depressive disorder, individuals diagnosed with major depressive disorder according to DSM-5 criteria

were excluded from the study. Six patients subsequently withdrew from the study, and four patients were excluded because they did not complete the scales in full; thus, the sample consisted of 50 individuals.

Measures

Sociodemographic and Clinical Data Form

A semi-structured questionnaire prepared by the researchers that includes sociodemographic information about the participants—such as gender, age, place of residence, and employment status—as well as clinical data such as duration of illness.

Beck Depression Inventory (BDI)

Developed to measure the level and severity of depressive symptoms in adults, the scale score increases as depressive symptoms increase. Validity and reliability studies of the scale have been conducted in Turkish; in this study, the BDI's internal consistency coefficient (Cronbach's alpha) was calculated as 0.76. According to the interpretation of scale scores, a score range of 0–9 indicates minimal depressive symptomatology, 10–16 indicates mild depressive symptomatology, 17–24 indicates moderate depressive symptomatology, and scores of 25 and above indicate severe depressive symptomatology (Beck 1961, Hisli 1989).

Statistical Analysis

Analyses were performed using SPSS (Statistical Package for the Social Sciences; SPSS Inc., Chicago, IL) version 22. In this study, descriptive statistics were presented as n and % for categorical variables, and as the median and interquartile range (25th–75th percentiles) for continuous variables. The normality of the continuous variables was assessed using the Kolmogorov-Smirnov testThe Mann–Whitney U test was used to compare BDI scores for binary variables (gender, education level, place of residence, and employment status); the Kruskal–Wallis test was used for variables with more than two categories (glaucoma severity in the right and left eyes). The relationship between BDI scores and continuous variables such as age, duration of disease, intraocular pressure, retinal nerve fiber layer thickness, visual field scores, mean deviation, and pattern deviation was examined using Spearman's correlation analysis.

The independent variables to be included in the multiple linear regression model were determined based on sociodemographic variables found to be associated with the BDI score in univariate analyses ($p<0.25$) and those reported in the literature to be associated with depression. Accordingly, age, gender, education level, and employment status were included in the model as independent variables using the enter method. Model fit was assessed using the F-test and the R^2 value; multicollinearity was assessed using the VIF; and the independence of the residuals was assessed using the Durbin–Watson test.

Results

A total of 50 patients with PAAG were included in the study, comprising 25 (50%) women and 25 (50%) men. The mean age of the patients was 58.0 (51.0–59.0) years. Fifty-two percent of the patients had a middle school education or lower, while 48% had a high school education or higher. Seven percent of the patients lived in rural areas, while 93% lived in urban areas; 26% were employed. Other patient characteristics are shown in Table 1.

Women's BDI scores were found to be statistically significantly higher than those of men ($p=0.012$). The BDI scores of individuals with a middle school education or lower were found to be significantly higher than those of individuals with a high school education or higher ($p<0.001$). In contrast, BDI scores for employed individuals were found to be statistically significantly lower than those of unemployed individuals ($p=0.006$) (Table 2).

A positive and statistically significant correlation was found between BDIscores and age (Table 3).

Table 1. Demographic and clinical characteristics of sample			
Variables		**n**	**%**
Sex	Female	25	50.0
	Male	25	50.0
Educational Level	≤ Middle school	26	52.0
	≥ High school	24	48.0
Place Of Residence	Rural	3	7.0
	Urban	40	93.0
Employment Status	Employed	13	26.0
	Unemployed	37	74.0
Right Eye Glaucoma Severity	Mild	19	38.0
	Moderate	13	26.0
	Severe	18	36.0
Left Eye Glaucoma Severity	Mild	15	30.0
	Moderate	9	18.0
	Severe	26	52.0
		Median (IQR)	
Age		58.0 (51.0-59.0)	
Disease duration (years)		8.0 (4.0-15.0)	
Number of antiglaucoma medications		2.0 (2.0-3.0)	
Right intraocular pressure (mmHg)		15.0 (13.0-18.0)	
Left intraocular pressure (mmHg)		15.0 (12.0-18.0)	
Right retinal nerve fiber layer (RNFL) thickness (μm)		95.0 (78.0-102.0)	
Left retinal nerve fiber layer (RNFL) thickness (μm)		90.0 (71.0-102.0)	
Integrated binocular visual field score		96.0 (81.0-99.0)	
Functional visual field		91.8 (77.8-97.8)	
Functional vision score		85.7 (67.8-95.0)	
Right visual acuity		1.0 (.7-1.0)	
Left visual acuity		.9 (.3-1.0)	
Right eye mean deviation (MD, dB)		-7.0 (-17.2--4.2)	
Left eye mean deviation (MD, dB)		-9.6 (-19.9--4.4)	
Right eye pattern standard deviation (PSD, dB)		4.1 (3.1-5.8)	
Left eye pattern standard deviation (PSD, dB)		4.1 (2.7-5.7)	
Beck Depression Inventory score		12.0 (9.0-16.0)	

Table 2. BDI scores by sociodemographic characteristics			
Variables		**BDI**	**p***
		Median (IQR)	
Sex	Female	13.0 (11.0-18.0)	0.012
	Male	10.0 (6.0-14.0)	
Educational Level	≤ Middle school	14.0 (13.0-19.0)	<0.001
	≥ High school	10.0 (5.5-11.0)	
Place of Residence	Rural	14.0 (9.0-16.0)	0.668
	Urban	11.0 (8.0-15.5)	
Employment Status	Employed	10.0 (5.0-10.0)	0.006
	Unemployed	14.0 (10.0-17.0)	
Right Eye Glaucoma Severity	Mild	11.0 (9.0-16.0)	0.653**
	Moderate	10.0 (9.0-14.0)	
	Severe	14.0 (6.0-16.0)	
Left Eye Glaucoma Severity	Mild	13.0 (10.0-19.0)	0.529**
	Moderate	10.0 (6.0-14.0)	
	Severe	13.5 (9.0-16.0)	

*p values were calculated using the Mann–Whitney U test; BDI: Beck Depression Inventory.

Table 3. Correlations between BDI scores and other parameters		
Variables	**BDI**	
	r	p
Age	0.349	0.013
Disease duration (years)	0.212	0.139
Number of antiglaucoma medications	0.001	0.997
Right intraocular pressure (mmHg)	0.142	0.326
Left intraocular pressure (mmHg)	0.229	0.109
Right retinal nerve fiber layer (RNFL) thickness (μm)	0.165	0.252
Left retinal nerve fiber layer (RNFL) thickness (μm)	0.058	0.689
Integrated binocular visual field score	0.076	0.600
Functional visual field	0.055	0.706
Functional vision score	0.029	0.844
Right eye mean deviation (MD, dB)	-0.139	0.335
Left eye mean deviation (MD, dB)	0.043	0.769
Right eye pattern standard deviation (PSD, dB)	-0.251	0.079
Left eye pattern standard deviation (PSD, dB)	-0.083	0.565
Right eye pattern standard deviation (PSD, dB)	0.132	0.361
Left eye pattern standard deviation (PSD, dB)	0.207	0.148

BDI: Beck Depression Inventory

In the multiple linear regression analysis conducted with the BDI score as the dependent variable, age, gender, education level, and employment status were included in the model. The model was found to be statistically significant ($F(4,45)=3.805$; $p=0.010$) and explained 25.3% of the variance in the BDI score ($R^2=0.253$; adjusted $R^2=0.186$). Educational level was found to be independently associated with BDI scores ($\beta=-0.460$; $p=0.015$). Patients with a higher educational level had significantly lower depression scores. Gender, age, and employment status, however, were no longer significant in the multivariate analysis ($p>0.05$) (Table 4).

Table 4. Multiple linear regression analysis of sociodemographic variables associated with BDI scores					
Variables	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**p**
	B	SE	Beta		
Sex	.048	2.289	.003	.021	0.983
Age	.037	.144	.040	.255	0.800
Educational level	-6.681	2.650	-.460	-2.521	0.015
Employment status	.698	3.054	.042	.229	0.820

BDI: Beck Depression Inventory; SE: Standard error; β: Standardized regression coefficient.

Discussion

The findings of this study revealed that glaucoma patients exhibit mild depressive symptoms and that this psychological state is independent of the severity of ocular involvement. In patients diagnosed with glaucoma, women, individuals with lower levels of education, and the unemployed are at higher risk for depressive symptoms, and that depression increases with age among glaucoma patients.

It is well known that chronic and progressive physical illnesses affect mental health (Dogan et al. 2024, Gürok 2024). Furthermore, because the brain and the retina develop from the same neuroectoderm and thus share the same structural and functional characteristics, neurodegenerative diseases are thought to be associated with them (Pradhan and Das 2021). In patients with glaucoma, female gender and being unmarried, duration of the disease, comorbidity with cerebrovascular disease, and the concurrent use of systemic beta-blockers and calcium channel blockers have been found to be associated with depression (Wu et al. 2020). However, a study by Zhou et al. (2013) demonstrated that female gender is not a predictor of depression in patients with glaucoma (Zhou et al. 2013). A cohort study conducted in Taiwan found that the risk of developing depression was significantly higher among patients with glaucoma, and it was reported that glaucoma, along with advanced age, being female, low income, substance abuse, and living

alone, are significant risk factors for depression (Chen et al. 2018). A 2022 review study showed that advanced disease stage, advanced age, female gender, and faster progression of vision loss were identified as potential risk factors for depression in patients with glaucoma (Stamatiou et al. 2022). In another study involving 182 patients with advanced-stage open-angle glaucoma, the majority of participants were women, and their mean age was 59.7 ± 13.3 years (Onwubiko et al. 2020). The present study also showed that among patients diagnosed with glaucoma, women, individuals with lower educational levels, and the unemployed are at higher risk for depression, and that the prevalence of depression increases with age in glaucoma patients. As in some of the studies mentioned above, in the present study we hypothesized that younger patients with open-angle glaucoma (PAAG) might have a higher burden of depression. This could be due to the cross-sectional nature of our study, or it could stem from the sadness experienced by older individuals as they become more vulnerable due to vision loss associated with advancing age.

One of the mechanisms proposed to explain the relationship between glaucoma and depression is that both conditions share a common neuroectodermal origin. In this context, it has been suggested that the morphological changes observed in glaucoma are not limited to ocular pathology but may be part of a broader neurodegenerative process. Given that depression is also associated with neurodegenerative and neuroinflammatory mechanisms, it is hypothesized that there may be a biological link between the two conditions (Pradhan and Das 2021). We observed that patients with glaucoma exhibited mild depressive symptoms, and we found that this psychological state was not associated with the severity of glaucoma in the affected eye. A 2020 study reported that 76 participants with glaucoma (41.8%) experienced depression, and that increased glaucoma severity and decreased visual acuity were significantly associated with depression (Onwubiko et al. 2020). Wang et al. demonstrated that primary open-angle glaucoma increases the risk of developing depression and that this risk increases progressively with the presence and severity of concomitant visual impairment. Once again, the effect of glaucoma and visual impairment on newly onset depression was greater in men (Wang et al. 2025). A meta-analysis reported a higher prevalence and severity of depression in patients with glaucoma compared to those without glaucoma; however, it did not address the severity of glaucoma (Groff et al. 2023). A study found that 16% of adults aged 60 and older diagnosed with primary open-angle glaucoma had depression; it also showed that higher rates of depression were observed in those with end-stage glaucoma, and that there was a correlation between average depression scale scores and the severity of both glaucoma and visual field defects (Tharmathurai et al. 2022). Another meta-analysis found that the prevalence of depression and the risk of depression in individuals with glaucoma were significantly higher compared to controls without glaucoma; however, the authors noted that the current evidence does not, on its own, demonstrate that this relationship is causal (Deng and Qin 2024). Just as the number of anticoagulant medications used may provide insight into the severity of glaucoma (Altay 2025), there are also studies indicating that eye drop prescriptions for glaucoma patients are significantly overprescribed, and that the eye drops used are essentially unrelated to factors such as glaucoma severity and visual acuity (Takao et al. 2024). In our study, we did not find a statistically significant association between the number of medications used to lower intraocular pressure and visual acuity in patients. This may be attributed to the limited size of our sample, or it may be interpreted as prescribing decisions being influenced by factors such as clinical preferences, patient adherence to treatment, and comorbid systemic diseases. Therefore, our findings highlight the need for more detailed studies to understand prescribing behaviors in the management of glaucoma. Additionally, our findings suggest that educational level has a significant effect on individuals' depression scale scores. The fact that depression scores decrease significantly as educational level increases may indicate that more educated individuals have stronger coping strategies and that education may enable glaucoma patients to be more proactive in seeking psychological support. Conversely, the lack of significant associations between other demographic characteristics, such as gender, age, and employment status, and depression scale scores in the multiple linear regression analysis suggests that these variables may have had a limited influence on depressive symptom severity in the present sample. This finding should be supported by studies conducted with a larger sample. Ultimately, while the current study highlights the relationship between educational level and mental health, it suggests that the effects of other sociodemographic variables on depression levels require further in-depth examination.

Current study did not find any statistically significant association between visual field, intraocular pressure, and retinal nerve fiber layer thickness and depression levels in patients diagnosed with PAAG. Howver another study (Shin et al. 2021) investigating the relationship between anxiety and depression and the progression of glaucoma, and aiming to elucidate the underlying mechanisms, demonstrated that disc hemorrhage, maximum intraocular pressure, and the rate of RNFL loss were significantly associated with high anxiety. A positive correlation was found between the rate of RNFL thinning and anxiety scale scores, and a significant association was also detected between RNFL loss and fluctuations in intraocular pressure. With regard to depression, mean visual field deviation and heart rate variability were found to be associated with severe depression. These findings suggest that psychological symptoms may increase the risk of glaucoma progression and may be associated with elevated intraocular pressure and optic disc hemorrhage (Shin et al. 2021). Our regression model, however, explained only 25.3% of the variance in depression scores; this indicates that some other factors that could influence depression were not assessed in our study. This suggests that depressive symptoms in patients with glaucoma may be associated not only with the objective severity of the disease but also with multidimensional factors such as genetic predisposition, personal coping, disease awareness, and quality of life. Therefore, although current sample group is small and cross-sectional, the fact that there is no direct link between objective parameters such as visual field loss or retinal nerve fiber layer thinning and the level of depression suggests that psychological symptoms in glaucoma patients do not arise solely from vision loss, and that environmental factors also play a significant role. Furthermore, the fact that no significant association was found between objective parameters such as retinal nerve fiber layer thickness, visual field, and intraocular pressure and depression levels suggests that this biological relationship may not be directly reflected. Despite their neuroectodermal common origin, further studies are needed to determine the potential benefit of monitoring depression risk in addition to tracking vision loss during the management of glaucoma in clinical practice.

Major limitation of the present study is the lack of a healthy control group. This limits our ability to compare changes in the levels of depressive symptoms observed in glaucoma patients—as they vary according to disease severity or age—with those in healthy individuals. In future studies, the inclusion of healthy control groups will increase the generalizability of the findings and may provide clearer results regarding the relationship between glaucoma and depressive symptoms. Another limitation is that age-related increases in depressive symptoms may be partially attributable to functional vision loss, and this effect was not controlled for in our study. Other potentially influential factors, such as genetic predisposition, personality traits, level of social support, or lifestyle, could not be included in the model due to the limitations of the available dataset. Other limitations include the study's single-center design, the use of a self-report questionnaire, and the relatively small sample size. Furthermore, the absence of a control group in the study limits the direct generalizability of the results to the general population. Our sample consisted solely of patients with open-angle glaucoma, and no comparison was made with healthy individuals. Furthermore, although each eye was evaluated separately, the cross-sectional design limits the ability to draw causal inferences.

Conclusion

Current study demonstrated the presence of mild depressive symptoms in patients with glaucoma. There are only a limited number of studies that examine both ocular measurements and depression levels in patients with primary open-angle glaucoma. This finding is clinically significant both for assessing patients' quality of life and for determining their psychosocial support needs, and may serve as a guide for future research in this field. In fact, it is known that quantitative ocular measurements play a decisive role in the progression of open-angle glaucoma. In the future, it will be important to evaluate the relationship between the course of glaucoma and psychological symptoms using long-term prospective designs in larger sample groups that include different subtypes of glaucoma. Furthermore, the combined assessment of psychosocial factors such as anxiety levels, social support, and cognitive function could lead to a better understanding of the psychiatric effects of glaucoma. Such multidisciplinary studies could facilitate the

early identification of glaucoma patients at high risk for depression before clinical symptoms manifest and the development of personalized support approaches.

References

Ahmed OM, Waisbourd M, Spaeth GL, Katz LJ (2021) Improvement in structure and visual function in patients with glaucoma: the possible key to better treatment? Surv Ophthalmol, 66:644-652.

Altay Y (2025) Which factor have more adverse effect on ocular surface of patients treated with antiglaucoma drops; drug type, number of drugs or drug intensity? Cutan Ocul Toxicol, 44:141-146.

Asrani SG, McGlumphy EJ, Al-Aswad LA, Chaya CJ, Lin S, Musch DC et al. (2024) The relationship between intraocular pressure and glaucoma: An evolving concept. Prog Retin Eye Res, 103:101303.

Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J (1961) An inventory for measuring depression. Arch Gen Psychiatry, 4:561-571.

Chang RT, Singh K (2016) Glaucoma suspect: diagnosis and management. Asia Pac J Ophthalmol, 5:32-37.

Chen YY, Lai YJ, Wang JP, Shen YC, Wang CY, Chen HH et al. (2018) The association between glaucoma and risk of depression: a nationwide population-based cohort study. BMC Ophthalmol, 18:146.

Chuangsuwanich T, Tun TA, Braeu FA, Wang X, Chin ZY, Panda SK et al. (2023) Differing associations between optic nerve head strains and visual field loss in patients with normal- and high-tension glaucoma. Ophthalmology, 130:99-110.

Cohen J (1988) Statistical Power Analysis for the Behavioral Sciences. 2nd ed. Hoboken, NJ, Lawrence Erlbaum.

Deng J, Qin Y (2024) From meta-analysis to Mendelian randomization: Unidirectional perspectives on the association of glaucoma with depression and anxiety. PLoS One, 19:e0310985.

Dietze J, Blair K, Zeppieri M, Havens SJ, Adams M (2024) Glaucoma (Nursing). In: StatPearls. Treasure Island (FL): StatPearls Publishing.

Dogan S, Yildiz S, Kilicaslan AK, Emir BS, Kurt O, Sehlikoğlu S (2024) Does anxiety, depression, and sleep levels affect the quality of life in patients diagnosed with multiple sclerosis? Eur Rev Med Pharmacol Sci, 28:1306-1313.

Fernandez-Lazaro CI, García-González JM, Adams DP, Fernandez-Lazaro D, Mielgo-Ayuso J, Caballero-Garcia A et al. (2019) Adherence to treatment and related factors among patients with chronic conditions in primary care: a cross-sectional study. BMC Fam Pract, 20:132.

Filatova EV, Shadrina MI, Slominsky PA (2021) Major depression: one brain, one disease, one set of intertwined processes. Cells, 10:1283.

Giacometti HHAR, Coelho LF, Iankilevich LG, Valentin LSS, Ferreira LA, Balbino M et al (2024) Prevalence of anxiety and depression among patients with glaucoma. Front Psychol, 15:1410890.

Groff ML, Choi B, Lin T, McIlraith I, Hutnik C, Malvankar-Mehta MS (2023) Anxiety, depression, and sleep-related outcomes of glaucoma patients: systematic review and meta-analysis Can J Ophthalmol, 58:346-355.

Gupta A, Bansal R, Sharma A, Kapil A (2024) Optic disc signs—cupping, swelling, inflammation, and pallor. In Ophthalmic Signs in Practice of Medicine. Singapore, Springer Nature, 423-472.

Gürok MG, Balgetir F, Yildiz S, Tabara MF (2024) Huzursuz bacak sendromu olan hastalarda aleksitimi ve diğer ruhsal semptomlar. Fırat Üniversitesi Sağlık Bilimleri Dergisi, 38:185-189.

Hisli N (1989) Beck Depresyon Envanteri'nin üniversite öğrencileri için geçerliği ve güvenirliği. Psikoloji Dergisi, 6:3-13.

Inayat H, Abdul-Nabi M, Leung B, Jiang J, Robertson S, Malvankar-Mehta MS (2024) Detrimental impact on work productivity in patients with glaucoma: a systematic review. JFO Open Ophthalmol, 8:100142.

Jayaram H, Kolko M, Friedman DS, Gazzard G (2023) Glaucoma: now and beyond. Lancet, 402:1788-1801.

Jesus J, Ambrósio J, Meira D, Rodriguez-Uña I, Beirão JM (2025) Blinded by the Mind: Exploring the Hidden Psychiatric Burden in Glaucoma Patients. Biomedicines, 13:116.

Onwubiko SN, Nwachukwu NZ, Muomah RC, Okoloagu NM, Ngwegu OM, Nwachukwu DC (2020) Factors associated with depression and anxiety among glaucoma patients. Niger J Clin Pract, 23:315-321.

Pradhan LK, Das SK (2021) The regulatory role of reticulons in neurodegeneration: insights underpinning therapeutic potential for neurodegenerative diseases. Cell Mol Neurobiol, 41:1157-1174.

Quaranta L, Riva I, Gerardi C, Oddone F, Floriani I, Konstas AG (2016) Quality of life in glaucoma: a review of the literature. Adv Ther, 33:959-981.

Rovelt J, Freiberg J, Azuara-Blanco A, Virgili G, Kolko M (2024) The multifaceted non-genetic risk factors for primary open-angle glaucoma: An overview of systematic reviews. Ophthalmol Glaucoma, 8:188-198.

Saccà SC, Cutolo CA, Rossi T (2019) Glaucoma: an overview. In: Handbook of Nutrition, Diet, and the Eye (Eds VR Preedy, RR Watson): 167-187. Cambridege, MA, Academic Press.

Schmidl D, Schmetterer L, Garhöfer G, Popa-Cherecheanu A (2015) Pharmacotherapy of glaucoma. J Ocul Pharmacol Ther, 31:63-77.

Shin DY, Jung KI, Park HYL, Park CK (2021) The effect of anxiety and depression on progression of glaucoma. Sci Rep, 11:1769.

Stamatiou ME, Kazantzis D, Theodossiadis P, Chatziralli I (2022) Depression in glaucoma patients: a review of the literature. Semin Ophthalmol, 37:29-35.

Takao E, Ichitani A, Tanito M (2024). Estimation of topical glaucoma medication over-prescription and its associated factors. J Clin Med, 13:184.

Tharmathurai S, Muhammad-Ikmal MK, Razak AA, Che-Hamzah J, Azhany Y, Fazilawati Q et al. (2021) Depression and severity of glaucoma among older adults in urban and suburban areas. J Glaucoma, 30:205-212.

Waisberg E, Micieli JA (2021) Neuro-ophthalmological optic nerve cupping: an overview. Eye Brain, 13:255-268.

Wang SM, Jung Y, Han K, Ohn K, Park HYL, Park CK et al (2025) Risk of depression in glaucoma patients with vision impairment: A nationwide cohort study. Heliyon, 11:e40617.

Wang Y, Guo Y, Zhang Y, Huang S, Zhong Y (2024) Differences and similarities between primary open-angle glaucoma and primary angle-closure glaucoma. Eye Brain, 16:39-54.

Wu A, Khawaja AP, Pasquale LR, Stein JD (2020) A review of systemic medications that may modulate the risk of glaucoma. Eye (Lond), 34:12-28.

Xu Y, Ye Y, Chen Z, Xu J, Yang Y, Zhang Y et al (2025) The impact of intraocular pressure changes on corneal biomechanics in primary open-angle glaucoma. Am J Ophthalmol, 269:216-225.

Zeppieri M, Marsili S, Enaholo ES, Shuaibu AO, Uwagboe N, Salati C et al. (2023) Optical coherence tomography (OCT): a brief look at the uses and technological evolution of ophthalmology. Medicina, 59:2114.

Zhou C, Qian S, Wu P, Qiu C (2013) Anxiety and depression in Chinese patients with glaucoma: sociodemographic, clinical, and self-reported correlates. J Psychosom Res, 75:75-82.

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