• Review Article •

Research progress on glaucoma complicated with anxiety and depression

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Abstract

● Glaucoma is a leading cause of irreversible blindness globally, with its incidence continuing to rise. Anxiety and depression are highly prevalent psychological comorbidities among patients with glaucoma. This narrative review summarizes the latest domestic and international research regarding anxiety and depression in glaucoma populations, focusing on their epidemiology, risk factors, bidirectional interactions with glaucoma, and relevant intervention strategies. This review aims to provide theoretical evidence for optimizing clinical psychosomatic comprehensive management regimens, so as to improve therapeutic outcomes and quality of life in glaucoma patients.

● **KEYWORDS:** glaucoma; anxiety; depression; prevalence; risk factors; bidirectional interactions; intervention measures

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INTRODUCTION

Glaucoma is characterized by optic nerve atrophy and visual field defects, with elevated intraocular pressure (IOP) being the primary risk factor. By 2040, the global glaucoma patient population is projected to reach 111.8 million[1]. Due to the insidious nature of early symptoms, most patients receive a diagnosis only at the disease's intermediate or advanced stages. Once visual function is impaired, the damage is irreversible, potentially leading to blindness. This severely impacts patients' quality of life and imposes a heavy disease burden and economic strain on individuals, families, and society[2-3].

For a long time, the clinical management of glaucoma has focused on controlling IOP to delay the progression of optic nerve damage. However, with the deepening of the biopsychosocial medical model, researchers and clinicians increasingly recognize that glaucoma, as a lifelong chronic disease, has impacts far beyond the ocular sphere, profoundly affecting patients' mental health and quality of life. The threat of vision loss, the complexity and long-term nature of treatment regimens, and the fear of future blindness collectively constitute persistent psychological stressors, significantly increasing the risk of developing anxiety and depression[4-6].

Conversely, anxiety and depression may indirectly exacerbate glaucoma progression by affecting treatment adherence and endocrine regulation, creating a vicious cycle of physiological and psychological interaction[7-8]. Therefore, systematically elucidating the current state of comorbidity between glaucoma and anxiety/depression, thoroughly analyzing its influencing factors, exploring the core mechanisms of their bidirectional interaction, and summarizing effective intervention measures holds crucial theoretical and practical significance for advancing comprehensive glaucoma management, breaking the aforementioned vicious cycle, and ultimately improving patients' overall health outcomes. This review aims to systematically summarize recent research advances in this field, with the goal of providing reference for clinical practice and future research.

MATERIALS AND METHODS

This paper is a narrative review aimed at synthesizing the current research progress on glaucoma combined with anxiety and depression. A literature search was conducted in PubMed, Google Scholar, and Web of Science, covering the period from January 2012 to January 2026. Earlier relevant studies

identified through reference screening were also included when appropriate. The search keywords included “glaucoma”, “anxiety”, “depression”, “prevalence”, “risk factors”, “bidirectional mechanisms”, “interventions”, “cognitive behavioral therapy (CBT)”, “mindfulness-based stress reduction”, “social support”, “exercise”, and “pharmacological treatments”.

Inclusion criteria were: original research articles, systematic reviews, Meta-analyses, and narrative reviews published in English with full-text availability, focusing on the epidemiology, risk factors, mechanisms, and intervention strategies for glaucoma combined with anxiety and depression. Exclusion criteria were: case reports, editorials, conference abstracts with incomplete data, and studies that were unrelated to the research focus, had incomplete information, or were duplicate publications.

After an initial screening of titles and abstracts, a full-text evaluation was conducted to identify eligible studies. The included literature was then organized and synthesized according to themes, forming the core content of this review, with an emphasis on integrating high-quality evidence from recent systematic reviews, Meta-analyses, and well-designed observational studies.

Epidemiology of Glaucoma Combined with Anxiety and Depression The epidemiological characteristics of anxiety and depression in glaucoma patients exhibit significant global regional variations and population specificity, with overall prevalence rates substantially higher than in the general population.

Globally, multiple systematic reviews and Meta-analyses have confirmed this association: one analysis encompassing 29 studies and over 13 million participants revealed that the prevalence of anxiety among glaucoma patients ranged from 12.11% to 49%, while the prevalence of depression ranged from 6.6% to 57%[9]. Another Meta-analysis incorporating 45 studies indicated that glaucoma patients had an anxiety prevalence of 25% [95% confidence interval (95%CI) 0.21–0.30] and a depression prevalence of 19% (95%CI 0.16–0.23)[10]. Additional studies quantifying relative risks (RR) found that glaucoma patients face a 2.99-fold increased risk of anxiety and a 5.92-fold increased risk of depression compared to control patients without glaucoma[11]. A Meta-analysis reported pooled prevalence rates of 19.07% for anxiety and 19.42% for depression among patients with glaucoma based on 16 and 18 cross-sectional studies, respectively, and further showed through pooled analyses of five case-control studies that patients with glaucoma had higher odds ratio (OR) of anxiety (OR=4.45) and depression (OR=6.17) than controls[12]. Cross-sectional and comparative studies across different regions reveal varying results: In Asia, Singaporean glaucoma patients exhibited a high prevalence of anxiety at 64% and depression at 30%[13]. The prevalence of anxiety among glaucoma patients in China ranges from 12.11% to 66.00%, and the prevalence of depression is between 16.40% and 56.00%[14-18]. An Indian comparative cross-sectional study reported anxiety and depression prevalence rates of 25.0% and 35.81%, respectively, both significantly higher than those in non-glaucoma controls[19]. Another study also confirmed that the prevalence of anxiety and depression is significantly higher than that in the general population[20]. In Europe, a cross-sectional study in German hospitals reported anxiety prevalence at 42.2% and depression at 34.9%[21]; however, a cohort study involving 14 657 individuals found no significant association between glaucoma and anxiety/depression[22]. A Croatian cross-sectional study showed anxiety prevalence of 63.8% and depression prevalence of 68.3% among glaucoma patients[5]. In the Americas, a Brazilian multicenter study reported anxiety at 25.71% and depression at 26.90%, representing 2.6-fold and 4.6-fold increases compared to the general population[23]. A retrospective USA study showed OR of 10.6 for anxiety and 12.3 for depression in glaucoma patients[24]. A Nigerian study in Africa reported prevalence rates of 44% for anxiety and 41.8% for depression[25].

Differences exist in study designs (such as hospital-based versus population-based studies), sample selection, glaucoma severity, patient characteristics, and the use of psychological assessment tools, leading to significant heterogeneity in the reported prevalence rates. Specifically, hospital-based studies typically focus on patient populations with more severe conditions or complex treatments, which may result in higher prevalence rates of anxiety and depression. In contrast, population-based studies may include patients with mild or untreated glaucoma, showing lower prevalence rates of anxiety and depression. Additionally, differences in sample characteristics such as age, gender, and socioeconomic status among studies may significantly influence patients’ mental health outcomes, thereby exacerbating the heterogeneity of research results. The severity of glaucoma is an important factor affecting anxiety and depression—especially when visual impairment and visual field defects worsen, patients’ psychological distress is usually more pronounced. However, different studies may adopt varying inclusion criteria for disease severity, which can lead to differences in patients’ mental states and further affect the estimation of prevalence rates. Furthermore, variations in psychological assessment tools are another key factor contributing to the heterogeneity of research results. Differences in sensitivity, specificity, and diagnostic criteria among different tools may lead to inconsistent assessments of anxiety and depressive symptoms, thereby impacting the reporting of prevalence

rates. Nevertheless, the vast majority of studies indicate that the prevalence rates of anxiety and depression among glaucoma patients are significantly higher than those in the general population, with only a few studies failing to find a significant association between the two. In the future, there is an urgent need to conduct standardized epidemiological studies on glaucoma, standardize assessment tools, sample selection criteria, and confounding factor control strategies, reduce methodological biases between studies, further validate the aforementioned conclusions, and thereby more accurately determine the prevalence rates of anxiety and depression among glaucoma patients (Table 1).

RISK FACTORS FOR GLAUCOMA COMBINED WITH ANXIETY AND DEPRESSION

Disease-Related Factors

Disease severity The severity of disease is one of the core factors influencing the psychological state of glaucoma patients. As glaucoma progresses to severe stages (or even blindness), patients face a significantly increased risk of developing anxiety and depression, making it a major risk factor for psychological issues[25-26]. Concurrently, a decline in vision-related quality of life is clearly associated with anxiety and depressive symptoms[21]. Research indicates that worsening visual impairment and visual field defects exacerbate psychological distress such as anxiety, further diminishing patients' quality of life and creating a negative cycle of "visual impairment-psychological issues-reduced quality of life"[27]. Targeted studies further indicate that both the best-corrected visual acuity of the worse eye and visual field status show significant correlations with anxiety and depression scores[28]. This finding corroborates the direct impact of visual impairment severity on psychological status. In summary, the severity of visual loss in glaucoma patients is closely associated with the onset and exacerbation of anxiety and depressive symptoms. Higher disease severity correlates with increased risk and severity of psychological issues, forming a clear positive relationship. This constitutes a core influencing factor that cannot be overlooked when clinically assessing patients' psychological status[23].

Disease progression Disease progression is closely linked to the onset and development of emotional issues in glaucoma patients, serving as a significant factor influencing their psychological state. As a chronic progressive disease, glaucoma involves long-term treatment, repeated follow-up appointments, and cumbersome medication regimens. Combined with the persistent threat of potential vision loss, these factors gradually increase patients' psychological burden, making them more susceptible to depression or anxiety. Research confirms that the longer the duration since glaucoma diagnosis, the more pronounced the decline in patients' quality of life, accompanied by a corresponding increase in psychological distress[5]. Particularly noteworthy is that the duration of glaucoma itself serves as an independent predictor of depressive symptoms[14]. This finding underscores the critical role of disease course management in mitigating psychological risks and provides essential evidence for developing targeted psychological intervention strategies in clinical practice.

Different glaucoma subtypes Due to differences in pathogenesis and disease progression characteristics among various glaucoma subtypes, the incidence of psychological issues also exhibits significant variation, representing a key disease-related factor influencing the occurrence of anxiety and depression in patients. Among primary glaucoma subtypes, a study directly comparing primary angle-closure glaucoma (PACG) and primary open angle glaucoma (POAG) found that PACG patients scored significantly higher on the self-rating anxiety scale (SAS) and self-rating depression scale (SDS) than POAG patients[15], suggesting greater psychological burden in PACG patients. Among other subtypes, a study comparing pseudoexfoliative glaucoma, POAG patients, and healthy controls demonstrated that among the three groups included in the study, pseudoexfoliative glaucoma patients exhibited the highest depression symptom scores, which were significantly higher than those in the POAG group[29]. Additionally, secondary glaucoma has complex etiologies. Its underlying conditions—such as uveitis, ocular trauma, diabetic retinopathy, and a history of intraocular surgery—constitute significant physiological and psychological stressors that also heighten the risk of anxiety and depression.

Demographic and Sociopsychological Factors

Age Age is a significant non-biological factor influencing the emotional state of glaucoma patients, exhibiting a nonlinear association with anxiety and depression. Specifically, younger glaucoma patients not only exhibit anxiety symptoms more readily but also report higher levels of anxiety subjectively. Depression, meanwhile, is more prevalent among older patients, though it also occurs in newly diagnosed younger individuals, with particularly high incidence rates among older patients with longer disease duration and more severe conditions[23,26]. Concurrently, studies indicate that the risk of comorbid anxiety and depression among glaucoma patients remains relatively stable across different age groups. The age-related differences primarily manifest in symptom expression. This variation may be related to differing life demands[24], psychological resilience, and social roles among patients of varying ages.

Gender Multiple studies confirm that female glaucoma patients exhibit significantly higher rates of anxiety and depression than their male counterparts. Compared to male patients, women not only face a higher risk of developing

Table 1 Summary of epidemiological studies on anxiety and depression in glaucoma patients

Publication year	Region	Study design	Sample size	Anxiety rate (%)	Depression rate (%)	Scales used	Key findings	Reference
2013	China	Hospital-based cross-sectional	506 glaucoma patients	22.92	16.40	HADS	Prevalence of anxiety and depression among Chinese glaucoma patients is relatively high	14
2015	China	Case-control study	50 PACG patients, 50 POAG patients, and 50 normal controls	PACG: 66 POAG: 44	PACG: 56 POAG: 40	SAS, SDS	The prevalence of anxiety and depression in patients with primary glaucoma is higher than that in normal controls	15
2016	Singapore	Hospital-based cross-sectional	100 glaucoma patients	64	30	HAM-D, HAM-A	The prevalence of depression and anxiety is relatively high in glaucoma patients	13
2017	United States	Retrospective case-control study	4439518 patients screened (including 11234 glaucoma patients)	17.1	22	ICD-9	There is a statistically significant association between glaucoma and anxiety (OR=10.6) as well as depression (OR=12.3)	24
2018	China	Hospital-based cross-sectional	263 patients with primary glaucoma and 100 patients with age-related cataract	29.66	27.76	HADS	HADS scores of glaucoma patients were higher than those of cataract patients	16
2018	Germany	Population-based cohort	14657 participants	5.3	6.6	GAD-2, PHQ-9	No significant association was found between glaucoma and depression or anxiety	22
2020	Nigeria	Hospital-based cross-sectional	182 glaucoma patients	44	41.8	HADS	The prevalence of anxiety and depression is high in glaucoma patients	25
2022	China	Hospital-based cross-sectional	446 glaucoma patients	12.11	25.78	HADS	Anxiety and depression are common among Chinese glaucoma patients	17
2022	China	Hospital-based cross-sectional	109 glaucoma patients	20.2	26.6	PHQ-9, GAD-7	The prevalence of anxiety and depression is relatively high in glaucoma patients	18
2022	India	Hospital-based cross-sectional	148 glaucoma patients and 150 non-glaucoma patients	25	35.81	PHQ-9, GAD-7	Depression and anxiety are common in glaucoma patients	19
2022	India	Hospital-based cross-sectional	200 glaucoma patients	14.5	20	HADS	One-third of the patients have symptoms of anxiety or depression	20
2023	Multi-region	Systematic review and Meta-analysis	45 studies, total sample size: 135565 cases, 4859973 controls	25 (95%CI 0.21-0.30)	19 (95%CI 0.16-0.23)	SAS, SDS, HAM-A, *etc.*	Depression and anxiety are more prevalent in glaucoma patients than in non-glaucoma patients	10
2024	Croatia	Hospital-based cross-sectional	201 patients with POAG	63.8	68.3	PHQ-9, GAD-7	The prevalence of anxiety and depression in glaucoma patients is significantly higher	5
2024	Brazil	Multicenter hospital-based cross-sectional study	210 glaucoma patients	25.71	26.90	PHQ-9, GAD-7	The prevalence of anxiety and depression in glaucoma patients is higher than that in the general population	23
2024	Multi-region	Meta-analysis	23 studies, 11845 glaucoma patients	19.07	19.42	SAS, SDS, HADS, *etc.*	The prevalence of depression and anxiety in glaucoma patients may be higher than that in the general population	12
2024	Multi-region	Systematic review and Meta-analysis	15 studies, total sample size: 24334 cases, 21793 controls	RR=2.99	RR=5.92	SAS, SDS, HADS, *etc.*	Glaucoma patients are more likely to experience depression and anxiety than non-glaucoma patients.	11
2025	Germany	Hospital-based cross-sectional	249 glaucoma patients	42.2	34.9	PHQ-9, GAD-7	The prevalence of anxiety and depression in glaucoma patients is higher than that in the general population	21
2025	Multi-region	Systematic review	29 studies involving a total of 13326845 participants	12.11–49	6.6–57	HADS, GAD-7, PHQ-9 *etc.*	The prevalence of mental disorders, especially depression and anxiety, is significantly higher in glaucoma patients than in the general population	9

POAG: Primary open angle glaucoma; PACG: Primary angle-closure glaucoma; HADS: Hospital Anxiety and Depression Scale; PHQ-9: Patient Health Questionnaire-9; GAD-7: Generalized Anxiety Disorder-7; HAM-D: Hamilton Depression Scale; HAM-A: Hamilton Anxiety Scale; SAS: Self-Rating Anxiety Scale; SDS: Self-Rating Depression Scale; OR: Odds ratios; RR: Relative risk; CI: Confidence interval. For Reference 11, the reported values represent relative risks rather than prevalence rates.

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anxiety and/or depression[30], but are also more susceptible to depressive moods and psychological stress[31]. Research further demonstrates that elevated anxiety scores correlate with female gender[21]. Furthermore, gender differences become more pronounced in the later stages of the disease—women are more likely to develop depressive symptoms in advanced glaucoma, and those with faster visual function deterioration face an even higher risk of depression[32]. This underscores the need for clinical attention to the psychological well-being of female patients, particularly those in advanced stages.

Socioeconomic status As a comprehensive indicator, socioeconomic status may influence the mental health of glaucoma patients. Population-based evidence indicates that lower socioeconomic status—reflected by greater socioeconomic deprivation, lower household income, and lower educational attainment—is associated with a higher likelihood of anxiety and depression[33]. Regarding educational attainment, it may also influence anxiety and depressive mood in glaucoma patients. Research indicates that educational level is a significant factor affecting depressive mood in glaucoma patients—this may be because patients with lower educational attainment face greater difficulties in understanding disease-related knowledge, thereby making them more prone to depression[16]. At the income level, studies have also confirmed that the prevalence of anxiety and depressive mood among glaucoma patients is closely related to household economic income[34]. Regarding occupational characteristics, evidence from older adults suggests that occupational levels may be associated with anxiety and depressive symptoms[35]. In glaucoma patients, one study specifically highlighted that glaucoma patients engaged in "trade" occupations exhibited a significantly elevated risk of depression[25].

Other factors Marital status (*e.g.*, widowed, separated) has been identified as a significant sociodemographic risk factor influencing the emotional state of glaucoma patients[19]. One study revealed significantly higher anxiety levels among glaucoma patients living alone, suggesting that social support—particularly family companionship—may offer protective effects for patients' mental health[17]. This research has demonstrated that lack of social support is a major factor contributing to depression and anxiety in glaucoma patients[36]. Furthermore, glaucoma patients with comorbid systemic diseases also exhibit a relatively higher prevalence of anxiety and/or depression[20].

INTERACTION BETWEEN GLAUCOMA AND ANXIETY/DEPRESSION

Impact of Glaucoma on Anxiety and Depression When patients receive a glaucoma diagnosis, they may experience significant psychological stress, leading to a decline in mental health[37]. The threat of vision loss, lifelong medication requirements, potential surgical risks, and financial burdens may all contribute to anxiety and depressive symptoms[38]. Visual impairment not only affects activities of daily living (*e.g.*, reading, driving) but may also impair social functioning—as visual cues play a crucial role in social interactions, such as recognizing others, interpreting facial expressions, and understanding body language. The resulting decline in functional independence and reduced social engagement further exacerbates psychological distress, inducing negative states such as feelings of worthlessness, low mood, and irritability, creating a cumulative effect of psychological burden[39].

Effects of Anxiety and Depression on Glaucoma Progression While glaucoma negatively impacts mental health, anxiety and depression can also influence the progression of the disease, creating a bidirectional relationship[40]. The mechanisms through which psychological disorders influence glaucoma progression include:

Neuroendocrine dysregulation Chronic psychological stress activates the hypothalamic-pituitary-adrenal axis, leading to elevated cortisol levels[41]. Increased cortisol impairs aqueous humor dynamics, resulting in elevated IOP and exacerbating the pathological progression of glaucoma[42]. As a neuropeptide with neuroprotective effects on the optic nerve, studies have confirmed that the serum level of neuropeptide Y (NPY) in glaucoma patients with anxiety or depressive symptoms is significantly lower than that in patients without psychiatric symptoms[43]. This indicates that reduced NPY levels may be one of the mechanisms through which anxiety and depression influence the progression of glaucoma.

Vascular dysfunction Anxious individuals tend to exhibit heightened baseline sympathetic responses, which predispose them to sympathetic activation[44]. Depressed individuals, on the other hand, display altered autonomic balance with a tendency toward increased sympathetic tone[45]. This excess sympathetic activation triggers catecholamine release, leading to ocular vasoconstriction that impairs optic disc perfusion, further damaging the optic nerve.

Neuroinflammation Neuroinflammation may play a role in the pathogenesis of glaucoma[46]. Inflammasome pathways (such as NLR family pyrin domain-containing 3 and NLR family CARD domain-containing 4) can activate the release of proinflammatory cytokines including interleukin-1β and interleukin-18, which exacerbate ocular inflammatory responses and worsen optic nerve damage[47]. Meanwhile, chronic psychological stress associated with anxiety and depression can also activate microglia, inducing the release of proinflammatory cytokines such as interleukin-1β and tumor necrosis factor-α, thereby further amplifying the inflammatory response in the optic nerve[48].

Behavioral factors and treatment adherence Psychological vulnerabilities such as anxiety, depression, and stress may

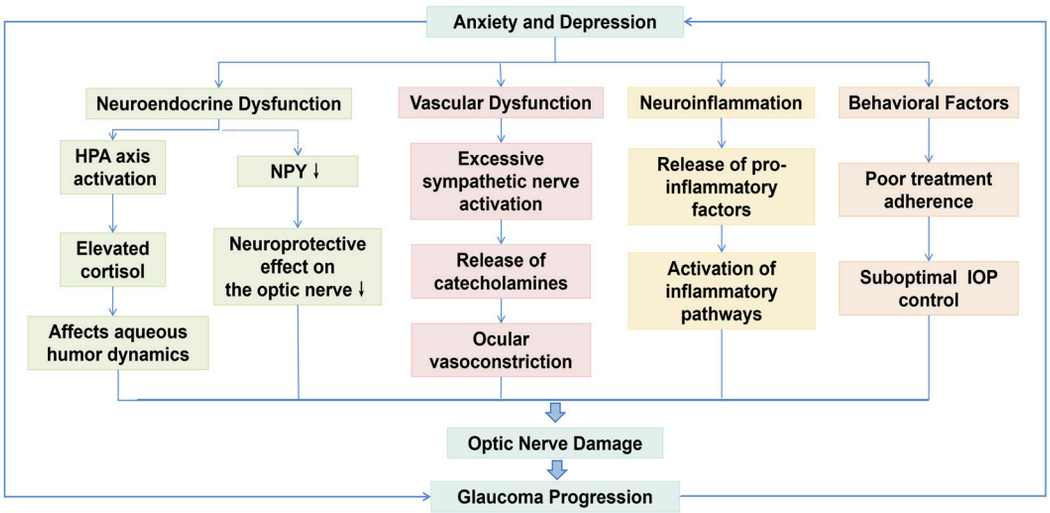

Figure 1 Schematic diagram of mechanistic pathways related to anxiety, depression and glaucoma progression Solid lines indicate relatively well-supported pathways; dashed lines indicate potential or proposed mechanisms. HPA: Hypothalamic-pituitary-adrenal; NPY: Neuropeptide Y; IOP: Intraocular pressure.

negatively affect adherence to IOP-lowering therapy in patients with glaucoma. Poor medication adherence may, in turn, contribute to disease progression, potentially creating a vicious cycle[49]. Taken together, the relevant mechanistic pathways associated with anxiety, depression and glaucoma progression are visually summarized in Figure 1.

Causal Relationship Between Glaucoma and Anxiety/Depression Glaucoma interacts with anxiety and depression, yet current evidence has not yet confirmed a definitive causal relationship between them, and the causal direction as well as the underlying mechanisms of this association remain to be elucidated. Relevant genetic studies have been conducted to explore this causal link: for instance, an analysis investigating the causal association between glaucoma and anxiety disorders has not yet identified evidence supporting a direct causal relationship between the two[50]; another study employing genome-wide linkage disequilibrium score regression, Mendelian randomization, and Bayesian colocalization analyses has similarly not yet obtained evidence confirming a clear causal relationship between negative emotions such as anxiety and depression and glaucoma[51]. The possible reasons include: first, the data could not be stratified by factors such as age, diet, and underlying conditions, leading to bias; second, the lack of genomic data covering other negative emotions limits further exploration; third, the small sample size of certain glaucoma subtypes results in insufficient statistical power; fourth, negative emotions were only defined through binary self-reports, failing to capture the complexity of emotions, which may lead to misclassification and false-negative results[51]. Future research should conduct more in-depth exploration to clarify whether there is a causal relationship between the two.

INTERVENTION MEASURES

Integrating Mental Health Management into Glaucoma Care Psychological interventions have proven to be highly effective in improving the emotional states of patients with chronic diseases. For example, elderly patients with osteoporotic fractures showed a significant reduction in anxiety and depression scores after a 5-week psychological care intervention[52]. Similarly, diabetic patients experienced significant improvements in negative emotions through individualized psychological care[53]. In the case of glaucoma patients, psychological interventions were also effective in alleviating anxiety, depression, and other negative emotions, leading to significant improvements in their mental health[54].

Psychological health management, through a systematic process of screening, referral, and continuous intervention, provides standardized support for the effective implementation of psychological interventions. Therefore, psychological health management systems should be integrated into the comprehensive diagnosis and treatment process for glaucoma. The specific implementation measures are as follows:

Incorporating mental health screening into routine diagnosis and treatment processes Mental health screening should be incorporated into the routine diagnosis and treatment of glaucoma. Standardized tools such as SAS, SDS, Patient Health Questionnaire-9 (PHQ-9), Generalized Anxiety Disorder-7 (GAD-7), Hospital Anxiety and Depression Scale (HADS), Hamilton Depression Scale (HAM-D), and Hamilton Anxiety Scale (HAM-A) should be used for assessment during patients' initial consultation and follow-up visits for disease progression. This helps medical staff promptly identify patients with severe emotional distress.

Identification criteria for high-risk patients To accurately identify high-risk patients, ophthalmologists should prioritize attention to the following groups.

1) Disease-related factors Patients with severe visual impairment, advanced glaucoma, or a long disease course. These groups are prone to anxiety and depression due to disease progression and unsatisfactory treatment outcomes.

2) Individual factors Female patients, elderly patients, and those with other comorbid chronic diseases. They are more likely to experience emotional distress and increased psychological burden when facing chronic illnesses.

3) Social factors Patients living alone, lacking social support, or facing economic difficulties. Due to insufficient emotional support or heavy economic pressure, they may experience loneliness and negative emotions.

Specific conditions should be evaluated based on the patient's individual health status and living background to prioritize screening and timely intervention.

Referral and collaboration mechanisms for mental health support

1) Preliminary screening and support Ophthalmologists are responsible for conducting preliminary mental health screening during routine diagnosis and treatment, and providing initial psychological support through patient education, emotional counseling, and other methods. These preliminary psychological nursing interventions can effectively help patients alleviate negative emotions such as anxiety and depression, provide early emotional regulation, and prevent the exacerbation of emotional problems.

2) Referral mechanism For patients whose screening results indicate severe anxiety or depression symptoms, ophthalmologists should refer them to psychiatry departments or professional psychological diagnosis and treatment institutions as early as possible for further evaluation and treatment. Early referral helps patients receive professional intervention before emotional symptoms worsen, thereby reducing the negative impact of emotional issues on treatment adherence and quality of life.

3) Multidisciplinary consultation Ophthalmologists, psychiatrists, and psychotherapists should jointly participate in patient consultations to develop individualized treatment plans, ensuring that ocular disease treatment and psychological nursing interventions are carried out simultaneously to improve the overall treatment effect.

Follow-up and continuous management of psychological interventions Ophthalmic nurses conduct regular telephone follow-ups to understand patients' emotional improvement and the progress of ocular treatment, ensuring the continuous effectiveness of psychological nursing interventions. Based on follow-up feedback, ophthalmologists and the psychological treatment team jointly evaluate the patient's emotional state and ocular treatment effect, and adjust the treatment plan in a timely manner to ensure the coordinated progress of mental health and ocular treatment.

By constructing a closed-loop management model of "screening-identification-referral-intervention-follow-up", we ensure that patients can receive timely and precise psychological support when needed, reduce the negative impact of emotional issues on treatment adherence and quality of life, and ultimately achieve the coordinated promotion of physical and mental health in the diagnosis and treatment of glaucoma.

Targeted Psychological Intervention Measures

Cognitive behavioral therapy CBT-based approaches may have value in the psychological care of patients with glaucoma. Evidence from a randomized glaucoma nursing study suggests that CBT-based nursing may help alleviate anxiety and depressive symptoms, enhance psychological resilience, improve visual acuity, reduce intraocular pressure, increase treatment adherence and nursing satisfaction, and contribute to better treatment outcomes[55]. Studies have shown that the level of disease cognition in glaucoma patients has a significant impact on their mental health[56]. Patients with higher cognitive levels are usually able to cope with disease changes in a more rational manner, experience less psychological pressure, and have higher treatment compliance, which supports the potential value of cognitive and educational interventions in the psychological care of patients with glaucoma.

In practice, ophthalmologists or psychotherapists can help patients identify and adjust their negative cognitive patterns through cognitive restructuring. For example, transforming patients' thought of "I will go blind and life will be meaningless" into a positive mindset of "Glaucoma can be controlled, and I can maintain my vision and improve my quality of life through treatment". In addition, regular glaucoma disease knowledge lectures or individual education should be carried out to help patients better understand the pathogenesis, treatment methods, and the importance of disease control through concise and understandable language and multimedia materials, thereby effectively improving their level of disease cognition.

Stress management training Mindfulness-based stress reduction is a psychological treatment method that focuses on helping individuals alleviate pain caused by mental, physical, and psychosomatic diseases through mindfulness meditation, while improving psychological symptoms such as anxiety and depression[57]. In addition, relevant review studies have confirmed that 30–60min of daily meditation can not only effectively improve IOP levels and ocular perfusion status in glaucoma patients, but also delay disease progression by

reducing psychological pressure and regulating emotional fluctuations, while alleviating the mental health burden caused by the disease[54].

In clinical practice, medical staff or psychotherapists can teach patients core meditation techniques such as mindfulness breathing and body scanning, and provide simple guidance materials for reference; patients are encouraged to carry out home practice in combination with their own work and rest schedules, adhering to the principle of physical and mental comfort; during patients' follow-up visits, the training progress should be monitored simultaneously, questions answered in a timely manner, and targeted guidance provided to ensure the continuity and intervention effect of the training.

Strengthening social support Social support is an important protective factor in the mental health management of glaucoma patients, which can indirectly optimize their quality of life by significantly enhancing their psychological resilience[58]. In terms of support types, professional interventions provided by social workers can help patients establish evidence-based disease management models (such as guiding the development of treatment plans and coordinating medical resources), while helping to reduce the severity of depressive symptoms[59]. More broadly, evidence from a longitudinal analysis within a randomized controlled trial suggests that increases in perceived social support may contribute to subsequent reductions in anxiety sensitivity among patients with anxiety disorders[60].

In clinical practice, the social support network for glaucoma patients can be improved by establishing patient mutual assistance groups and conducting family health education, helping patients obtain more emotional support and practical help in the process of disease management, thereby alleviating psychological pressure.

Exercise intervention In the chronic disease management system, regular physical exercise is an important intervention method to improve patients' mental health; for glaucoma patients, exercise can also indirectly maintain their mental health through physiological mechanisms. Studies have confirmed that specific types of exercise such as moderate-intensity aerobic exercise can temporarily reduce IOP, exert a positive effect on the severity and progression of glaucoma[61], and thereby alleviate the psychological burden of patients caused by disease progression. At the same time, exercise can provide positive support for mental health by regulating IOP, optimizing ocular blood flow, and exerting neuroprotective effects, helping to relieve emotional distress related to anxiety and depression[62].

Clinically, it is recommended to develop individualized exercise plans such as walking and jogging based on the patient's physical condition, and carry out regular physical exercise under safe premises to achieve dual benefits of physical and mental health.

Pharmacological Management When selecting psychiatric medications for glaucoma patients with comorbid anxiety and depression, extreme caution is warranted. Some antidepressants and anxiolytics can induce elevated IOP or acute angle-closure glaucoma (ACG) by altering pupil size, causing angle narrowing, or affecting aqueous humor dynamics. According to recent reviews[63], tricyclic antidepressants possess potent anticholinergic effects and should be avoided in patients at high risk for or diagnosed with ACG; benzodiazepines can cause angle narrowing and should be prescribed with caution, especially in elderly patients; topiramate increases IOP and should be avoided as much as possible in glaucoma patients. The use of selective serotonin reuptake inhibitors remains controversial: some studies have shown that this class of drugs is associated with an increased risk of glaucoma[64]; case-control studies have indicated that they may induce acute ACG, with a higher risk during the initial treatment stage. Therefore, for patients with narrow anterior chamber angle or at risk of ACG, extra caution should be exercised when using this class of drugs, and IOP should be closely monitored during the initial treatment stage[65]. However, other review evidence has shown that selective serotonin reuptake inhibitors and serotonin-norepinephrine reuptake inhibitors have a protective effect on open-angle glaucoma and no adverse effects on ACG, and are still safe and low-risk medication choices for glaucoma patients with comorbid anxiety and depression[63].

In clinical practice, it is recommended to establish a multidisciplinary collaboration mechanism between ophthalmology and psychiatry departments, and treatment plans should be developed through joint consultations by physicians from both disciplines. This model can not only avoid ocular adverse events caused by medications, but also ensure the improvement of emotional symptoms, achieving synergistic effects of ocular treatment and psychological treatment.

CONCLUSION

Glaucoma is closely associated with anxiety and depression, and the complex interaction between them has important implications for disease management, patient prognosis, and quality of life. In clinical practice, healthcare professionals should pay greater attention to patients' psychological well-being, promptly and comprehensively assess psychological problems while evaluating glaucoma severity, and improve their ability to identify and address these problems. On the basis of active and standardized IOP-lowering and optic nerve-protective treatments, comprehensive interventions involving cognitive, psychological, behavioral, and lifestyle modifications should be implemented. This approach aims to alleviate psychological symptoms, reduce the impact of visual

impairment, slow disease progression, and improve prognosis and quality of life.

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