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A Review Article On Neuro-Opthalmological Aspects Of Parkinson's Disease

[1]Thanuja Lanka, [2]Dr.Nishat Shaik,

[1]Student, [2]Assistant Professor,

[1]Department of Pharmacy Practice,

[1]Srinivasarao College of Pharmacy, Visakhapatnam, India

Abstract: Parkinson's disease (PD) is a neurodegenerative condition characterized by the selective impairment and loss of dopaminergic neurons in the substantia nigra. The disease's progression is influenced by various genetic factors, many of which remain functionally uncharacterized. These genetic functions primarily affect specific subcellular compartments such as mitochondria, lysosomes, and synapses. Additionally, ophthalmological issues are commonly observed in individuals with PD. This study aimed to uncover previously unrecognized eye disorders in PD patients. Remarkably, nearly 92% of participants exhibited significant ophthalmological issues. Many participants revealed previously undetected eye conditions that pose risks to vision and significantly impact daily activities. Therefore, regular ophthalmological evaluations are recommended for patients with PD.

Keywords: *Parkinson's disease, eye health, eye disorders, visual disabilities, non-motor symptoms.*

INTRODUCTION

Dr. Parkinson described Parkinson's disease as shaking palsy. This neurodegenerative disorder is marked by both motor and non-motor symptoms, profoundly affecting patients and their families due to its progressive nature. The primary cause of these symptoms is the degeneration of dopaminergic neurons in the substantia nigra. But what exactly is parkinsonism? It refers to a group of disorders that encompasses Parkinson's disease, with PD being the most prevalent form. There are also secondary causes, which include conditions that mimic PD as well as drug-induced factors.[1,2,3]Parkinson's disease (PD) is currently the most prevalent neurodegenerative disorder, affecting around 1 million people in the United States. The incidence of PD shows a gender disparity, with a ratio of approximately 3 males for every 2 females. Various genetic mutations and risk factors contribute to the development of Parkinson's disease. Key risk factors include oxidative stress, the generation of free radicals, and exposure to certain environmental toxins. [4,5]

Risk factors associated with Parkinson's disease are Elevated cholesterol, Environmental toxins, Head trauma, High-calorie intake, and oxidative stress[6]

HOW PARKINSON'S DISEASE IS DIAGNOSED?

The differential diagnosis of Parkinson's disease should involve a thorough medical history and physical examination, as there are no definitive tests to confirm the condition. The primary motor symptoms are typically the first clinical signs observed. Another key feature is postural instability, which affects about 50% of patients within five years of their diagnosis. [8] Clinically, younger patients (under 60) with Parkinson's disease may exhibit less rigidity and bradykinesia, which is characterized by slow movements, potentially leading to delayed or missed diagnoses. Experts also observe various movement disorders in PD patients and conduct nutritional studies to identify deficiencies. Additional diagnostic methods include bedside dopaminergic challenge tests using levodopa or apomorphine, though these are not widely endorsed by

neurologists. Other diagnostic evaluations may encompass neuropsychiatric assessments, sleep studies, vision tests, and primarily, ophthalmological examinations. [8]

Drug-induced parkinsonism (DIP) must be included in the differential diagnosis of Parkinson's disease (PD) since it represents one of the few reversible forms of the condition. Elderly women are particularly at risk for DIP. Medications frequently linked to this condition include antipsychotic drugs such as haloperidol, thiothixene, and risperidone.[9] Anti – Emetics that contain a phenothiazine core and gastrointestinal agents are so associated with DIP.

The primary approach for managing drug-induced parkinsonism (DIP) involves recognizing and stopping the medications that contribute to the condition, which typically alleviates symptoms, though there may be exceptions. Additionally, patients with Parkinson's disease often face various ophthalmological issues, such as burning eyes and visual hallucinations. If left untreated, these eye disorders can adversely affect physical activity, daily living tasks, and overall quality of life.

IMPACT OF OPHTHALMOLOGICAL DISORDERS

Currently, the effects are assessed using the 25-item National Eye Institute Visual Function Questionnaire (VFQ-25). [10]This assessment evaluates both visual impairment and related symptoms. A perfect score of 100 reflects optimal performance in daily activities. Let's explore the visual impairment questionnaire in more detail.

THE VISUAL IMPAIRMENT QUESTIONNAIRE (VIPD-Q)

The Visual Impairment in Parkinson's Disease (VIPD) tool is particularly effective for identifying ophthalmological issues associated with Parkinson's disease. It features 17 questions focused on eye-related symptoms, organized into four primary categories: 1) ocular surface, 2) intraocular, 3) oculomotor, and 4) optic nerve. Responses are rated on a four-point Likert scale, ranging from "never experienced symptoms" to "symptoms occurring daily." [11] The most common ophthalmological issues observed in Parkinson's disease patients included dry eyes (86%), misalignment of the eyes (50%), optic nerve disorders (50%), convergence insufficiency (41%), and cataracts (40%). Among these, dry eyes were identified as the most frequent symptom, affecting 86% of patients.

EFFECTS OF OPHTHALMOLOGICAL DISORDERS ON DAILY FUNCTIONING AND FALL RISK:

Ophthalmological conditions in patients with Parkinson's disease primarily affect their daily activities, as indicated by the VFQ-25. Key demographic factors include age, gender, duration of the disease, laterality (the more affected side of the body), education level, country of origin, comorbidities, and hypertension.

DISCUSSION:

In our study, a range of common and debilitating ophthalmological disorders was identified among Parkinson's disease patients over the age of 60. Nearly all participants (92%) experienced at least one clinically significant eye condition, and 44% reported difficulties in daily functioning due to these disorders.

To assess color vision, pseudo-isochromatic plates were utilized. For detecting more subtle color vision deficiencies, the Farnsworth Desaturated 15D hue test was conducted, which involves arranging 15 colored caps on trays based on their hue. Additionally, cataracts were evaluated using the Lens Opacities Classification System (LOCSIII) to rate lens opacity..

POPULATION PREVALENCE AND SEVERITY OF OPHTHALMOLOGICAL DISORDERS:

The significant prevalence of various ophthalmological disorders in our sample is striking, especially given that this issue often receives insufficient attention in everyday clinical practice. [12]

In the present generation, many PD patients suffer from visual impairment, once a correct diagnosis has been established then effective treatment is available. [13] Ophthalmological screening of PD patients is highly advisable.

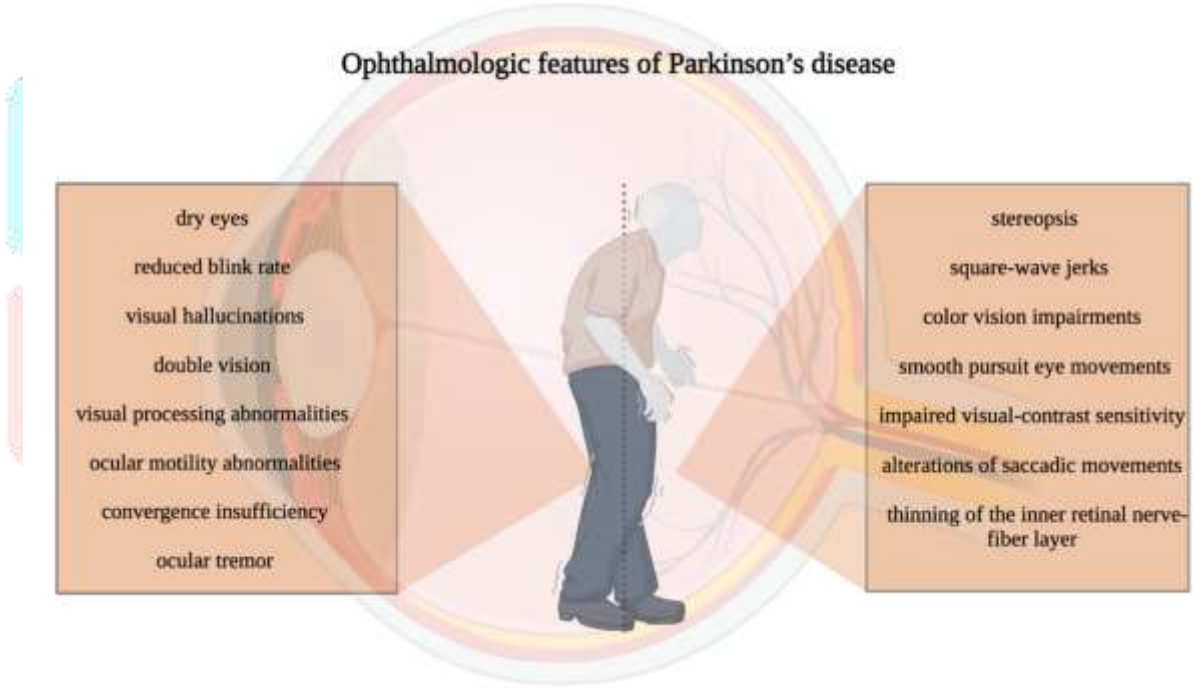
This analysis revealed that keratoconjunctivitis sicca, commonly referred to as dry eyes, was the most common ophthalmological condition Various factors may influence dry eyes, including reduced eye blink rate, dysfunction of the sebaceous glands, autonomic dysfunction, and blepharitis.[14] [15]

It was more prevalent among PD patients than controls, both in on and off-medication states. These problems can be effectively treated, for example with a prism or occupational therapy. [16] Changes in the optic nerve associated with Parkinson's disease are likely a result of primary neurodegeneration. The pattern of retinal thinning and visual field deficits in PD resembles that of glaucoma, characterized by relative preservation of fibers entering the optic nerve head nasally. In our cohort, only one patient exhibited elevated intraocular

pressure, while prior studies have indicated a higher incidence of open-angle glaucoma (OAG) in PD patients, suggesting a potential shared neurodegenerative mechanism.

However, there is currently no evidence to suggest that the risk of glaucoma is significantly greater in individuals with Parkinson's disease compared to healthy individuals. Our findings indicated a notably higher prevalence of potential glaucoma cases (17.5%) than expected in the general population (3.5%). This discrepancy calls for further research to avoid misinterpretation and the unnecessary treatment of pseudo glaucoma in PD patients. Additionally, maculopathy was observed in a quarter of our patients, primarily due to age-related macular degeneration (AMD). Only one other study has reported on the prevalence of AMD in Parkinson's disease, and its findings were lower than those in our data.[14]

Two studies reported an increased risk of a new diagnosis of PD when AMD was already previously diagnosed Although the only known overlapping factor is an increase in prevalence with aging. As the condition advances, visual abnormalities develop. Deficiencies in color vision, contrast sensitivity, and stereopsis are associated with the progression of the disease [17]. Accurate information on the effect of dopaminergic treatment on visual clinical manifestations is also provided; levodopa enhances color vision and contrast sensitivity in PD patients and may affect. [18] These findings support the notion that visual issues are linked to the well-documented degeneration of dopaminergic neurons in the retina, indicating that some symptoms may be mitigated by modifying visual input at the retinal level. The presence of visual impairments early in the disease could potentially serve as a marker for disease progression: color vision deficits are associated with a heightened risk of dementia in patients with Parkinson's disease, while defects in stereopsis correlate with more rapid cognitive decline. Thus, identifying visual anomalies could not only act as an early sign of Parkinson's disease but also serve as a predictor for complications and overall prognosis.



This image effectively illustrates the ophthalmological features present in patients with Parkinson's disease, including dry eyes, decreased blink rate, visual hallucinations, double vision, visual abnormalities, ocular tremors, square wave jerks, color vision deficits, difficulties with smooth pursuit eye movements, and changes in saccadic movements. The presence of visual impairments early in the disease may help predict its progression: for instance, color vision deficits are associated with an increased risk of dementia in Parkinson's patients, while issues with stereopsis are linked to quicker cognitive decline. Therefore, identifying these visual anomalies can serve not only as an early indicator of Parkinson's disease but also as a predictor of complications and overall prognosis. Visual impairments in this population can affect overall motor performance, leading to postural instability, a higher likelihood of falls, and a decreased quality of life; additionally, reduced contrast sensitivity has been connected to an increased risk of freezing of gait. [20] Individuals with the tremor-predominant phenotype, on the other hand, had fewer color vision impairments and a milder outcome .[21]The mechanisms behind these phenotypic differences remain unclear. One possible explanation for these discrepancies could be the presence of additional brain pathologies or the varying locations of α-synuclein deposits in affected individuals.

Moreover, individuals with rapid eye movement sleep behavior disorder who have not yet received a Parkinson's disease diagnosis exhibited changes in color vision. Additionally, color vision impairments in patients with this disorder have been identified as a risk factor for the progression of the disease..[21] Consequently, color vision deficits could be an initial diagnostic indicator of Parkinson's disease.

IMPACT OF EYE RELATED DISORDERS IN DAILY LIFE FUNCTIONING:

Non–motor symptoms such as ophthalmological disorders can be deliberated as motor symptoms in Parkinson's disease patients and contribute significantly to a poor quality of life [22] . In our study, approximately 44% of patients experienced ophthalmological disorders, including visual disabilities. However, this research did not address dry eyes as a factor affecting quality of life. Other studies on vision-related quality of life typically concentrated on the effects of individual ophthalmological symptoms, like visual disturbances. These disorders may also contribute to an increased incidence of falls and a decrease in physical activity. The primary risk factors for falls in Parkinson's disease are predominantly motor-related, such as freezing of gait and balance issues..

VALUE OF SCREENING THE QUESTIONNAIRE:

All the ophthalmological conditions we identified were potentially significant and warranted referrals to an ophthalmologist. It is important to recognize that some disorders, such as glaucoma, can progress asymptomatically until they reach a late stage. [23] In older adults, visual impairments frequently go unnoticed due to their subtlety, gradual progression, or the presence of concurrent cognitive issues. Additionally, patients often prioritize their motor symptoms, overlooking their vision problems, which means many ophthalmological issues may not be addressed during regular clinical visits. [24] Therefore, actual ophthalmological disease may be difficult to screen using a questionnaire on problems.

CONCLUSION

In conclusion, this article highlights that individuals with Parkinson's disease experience a range of ophthalmological disorders, including dry eyes, blurred vision, visual disabilities, color vision deficits, visual hallucinations, double vision, ocular motor issues, ocular tremors, abnormalities in visual processing, and impaired contrast sensitivity. Among these, dry eyes are the most prevalent, affecting 84% of patients in our study.

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