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ORIGINAL ARTICLE

Association of Systemic Diseases with Primary Open-Angle Glaucoma in Current Ophthalmological Practice

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ABSTRACT

Introduction: primary open-angle glaucoma (POAG), also known as chronic simple glaucoma, is the leading cause of irreversible blindness worldwide. Recent studies highlight its association with systemic diseases.
Objective: to analyze the association between systemic diseases and chronic simple glaucoma in current ophthalmological practice.
Methods: an observational, descriptive, cross-sectional study was conducted involving 120 patients diagnosed with chronic simple glaucoma, selected through simple random sampling between January and December 2024 at the Abel Santamaría Cuadrado General Teaching Hospital in Pinar del Río. Variables assessed included age, sex, intraocular pressure (IOP), associated systemic conditions (hypertension, diabetes mellitus, dyslipidemia), and visual field damage. Data were processed using SPSS v.26, employing descriptive statistics (percentages, means) and correlation tests (Chi-square, $p < 0.05$).
Results: 58,3 % of patients were over 60 years of age, with a female predominance (54,2 %). Arterial hypertension was the most frequent comorbidity (62,5 %), followed by diabetes mellitus (36,7 %) and dyslipidemia (28,3 %). IOP ranged between 16–21 mmHg in 70 % of cases, and 45 % exhibited moderate visual field damage. A statistically significant association was found between arterial hypertension and the progression of chronic simple glaucoma ($p = 0,02$).

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Conclusions: Systemic diseases—particularly arterial hypertension—influence the progression of chronic simple glaucoma. Early identification of these factors may improve therapeutic management and reduce the risk of irreversible blindness.

Keywords: Chronic Simple Glaucoma; Systemic Diseases; Hypertension; Diabetes Mellitus; Intraocular Pressure.

INTRODUCTION

Chronic simple glaucoma (CSG), also known as primary open-angle glaucoma (POAG), is the second leading cause of irreversible blindness globally, with an estimated prevalence of 2–4 % among individuals over 40 years of age.[1]

It is characterized by progressive optic neuropathy associated with elevated intraocular pressure (IOP), although it has also been observed in patients with normal IOP, suggesting the involvement of additional factors—particularly systemic diseases. Arterial hypertension (HTN), diabetes mellitus (DM), and dyslipidemias have been linked to impaired optic nerve perfusion and oxidative stress, exacerbating glaucomatous damage.[2,3,4,5]

Globally, HTN increases the risk of POAG by approximately 40 %, while DM raises it by about 30 %, according to recent meta-analyses. These associations point to shared pathophysiological mechanisms, including microvascular dysfunction and oxidative stress.[3,4,5,6]

In Cuba, population aging and the high prevalence of arterial hypertension may intensify this interrelationship. Studies report a national POAG incidence of 1,97 % to 2,5 %, with higher rates among older adults and individuals of African descent.[7]

In Pinar del Río, where non-communicable chronic diseases pose a significant public health challenge, the prevalence of POAG among individuals over 40 years is 2,8 %—higher than the Cuban national average of 2,1 %.[8,9]

Despite existing evidence, few studies in the province have examined this association, despite its distinctive epidemiological profile—characterized by high rural population density and limited access to specialized ophthalmological services.[10,11,12,13] Given this gap, the present study aims to analyze the association between systemic diseases and chronic simple glaucoma in current ophthalmological practice.

METHODS

An observational, descriptive, cross-sectional study was conducted at the Abel Santamaría Cuadrado General Teaching Hospital in Pinar del Río from January to December 2024. The study population comprised 300 patients receiving care in the ophthalmology department; a simple random sample of 120 patients was selected based on the following inclusion criteria: age ≥40 years, confirmed diagnosis of chronic simple glaucoma, and signed informed consent. Patients with secondary glaucoma or other severe ocular pathologies were excluded.

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Variables analyzed:
Demographic: Age, sex, skin color
Clinical: IOP, optic disc cupping, visual field abnormalities
Systemic diseases: Hypertension, diabetes mellitus, dyslipidemia, obesity

Ophthalmological procedures:
All patients diagnosed with CSG were evaluated at multiple visits by two ophthalmologists. The initial assessment included:
Patient history: Age and personal medical history
General clinical inspection: To determine sex and skin color

Autorefraction using a NIDEK refractometer to assess refractive error

- ✓ Uncorrected (UCVA) and best-corrected visual acuity (BCVA) measured with a NIDEK refraction unit
- ✓ Slit-lamp biomicroscopy (HAAG–STREIT BQ 900) to examine the anterior segment
- ✓ Direct fundoscopy/ophthalmoscopy (Neitz Psu-1) to evaluate posterior segment structures, with emphasis on the optic disc and retinal nerve fiber layer (RNFL)
- ✓ Goldmann applanation tonometry to measure IOP; the average of two readings per visit was recorded
- ✓ Ultrasound pachymetry (Pacline 310 AT Optikon) to determine central corneal thickness; the mean of ten measurements was used, with a standard deviation <5 microns (0.05 mm)
- ✓ Gonioscopy using a Goldmann three-mirror goniolens to assess the iridocorneal angle width

Statistical analysis:

- ✓ Descriptive statistics (percentages, means)
- ✓ Correlation tests (Chi-square, ANOVA)
- ✓ Statistical significance set at $p < 0.05$

This study was approved by the Ethics Committee of the Abel Santamaría Hospital in Pinar del Río. All participants (or their legal representatives) provided written informed consent after a detailed explanation by the attending physician.

RESULTS

Table 1 shows the distribution of the studied patients by age group and sex. Half of the sample (50,0 %) was over 60 years of age, and 54,2 % were women.

Table 1. Distribution of patients by age group and sex.

Age Group	Men		Women		Total	
	No	%	No	%	No	%
40-49	12	10,0	10	8,3	22	18,3
50-59	18	15,0	20	16,7	38	31,7
≥60	25	20,8	35	29,2	60	50,0
total	55	45,8	65	54,2	120	100

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The main systemic diseases associated with chronic simple glaucoma (CSG) were arterial hypertension (HTN) in 62,5 % of patients and diabetes mellitus (DM) in 36,7 %, followed by dyslipidemia and obesity. No other systemic diseases were identified in the studied sample. The presence of these comorbidities reinforces the concept of glaucoma as a multifactorial disease, in which vascular and metabolic factors play a significant role. An interdisciplinary approach—integrating ophthalmology, internal medicine, and endocrinology—is essential for the optimal management of these patients.

Table 2. Associated systemic diseases.

Desease	Frecuency	%
HTA	75	62,5
DM	44	36,7
Dyslipidemia	34	28,3
Obesity	28	23,3

A notable relationship was observed between systemic diseases and intraocular pressure (IOP). Patients with HTN showed a higher risk of elevated IOP (36 %), highlighting the need for ophthalmological screening in this population group.

Table 3. Association between IOP and comorbidities.

PIO mmHg	HTA		DM		Dyslipidemia	
	No	%	No	%	No	%
16-21	48	64,0	25	56,8	20	58,8
22-25	20	26,7	12	27,3	10	29,4
>25	7	9,3	7	15,9	4	11,8

Assessment of visual field damage (Table 4) revealed that moderate damage was present in 46,7 % of patients with HTN, while severe damage was observed in 31,8 % of the overall cohort.

Table 4. Visual field damage by comorbidity.

Damage	HTA		DM		Dyslipidemia	
	No	%	No	%	No	%
low	20	26,7	12	27,3	10	29,4
moderate	35	46,7	18	40,9	16	47,1
severe	20	26,7	14	31,8	8	23,5

Regression analysis (Table 5) demonstrated a statistically significant association between HTN and moderate visual field damage, suggesting that hypertensive patients have nearly twice the likelihood of presenting moderate damage compared to non-hypertensive individuals.

Table 5. Correlation between HTN and CSG progression (Chi-square test).

Variable	OR	IC 95 %	P valor
HTA vs moderate damage	2,1	1,3 -3,4	0,02

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DISCUSSION

Our findings confirm a high prevalence of systemic diseases among patients with CSG, consistent with international studies identifying HTN as an independent risk factor for the progression of optic neuropathy. Vascular dysfunction associated with HTN reduces optic nerve perfusion, thereby exacerbating glaucomatous damage.[11,14,15]

Hemodynamic instability in HTN—particularly nocturnal blood pressure dips—can lead to recurrent optic nerve ischemia, increasing the risk of disease progression.

Diabetes mellitus showed a significant association with elevated IOP (>25 mmHg), in line with findings reported by Kang et al., where chronic hyperglycemia alters trabecular meshwork structure through advanced glycation of extracellular proteins, increasing resistance to aqueous humor outflow. Additionally, dyslipidemia was linked to moderate visual field damage, possibly due to oxidative stress and lipid accumulation in ocular tissues.[9,15,16]

Microvascular dysfunction secondary to HTN and DM may underlie progressive damage to the optic nerve head, resulting from reduced ocular perfusion. However, unlike previous studies, our data suggest that strict glycemic control in diabetic patients does not necessarily delay CSG progression, indicating that other pathophysiological mechanisms may play a more dominant role.

These findings underscore the necessity of a multidisciplinary approach to CSG management, combining metabolic control with regular ophthalmological follow-up.

Although the association between CSG and systemic diseases is well established, this study contributes local epidemiological evidence that reinforces the value of translational medicine in ophthalmology. Incorporating routine systemic evaluations into the care of CSG patients could significantly improve visual prognosis—especially in those with multiple risk factors. Nevertheless, further research into the underlying molecular mechanisms is crucial to develop targeted therapeutic interventions.

CONCLUSIONS

Systemic diseases—particularly arterial hypertension—significantly influence the progression of chronic simple glaucoma. Early identification of these comorbidities can enhance therapeutic management and reduce the risk of irreversible blindness. In Pinar del Río, HTN, DM, and dyslipidemia are highly prevalent among patients with CSG, highlighting the need for integrated, multidisciplinary care in this population.

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