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QUANTIFICATION OF THE RISK OF CERTAIN PARAMETERS FOR CATARACT IN PATIENTS WITH GLAUCOMA

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Abstract

Cataract and glaucoma are among the most common ophthalmological diseases that lead to reduced visual acuity in the elderly population. These diseases often coexist, and their interrelationship is the subject of numerous studies.

This study aimed to quantify the risk of cataract development in patients with glaucoma, stratified by age, gender, diabetes, prior glaucoma surgery, and corticosteroid use.

This research was designed as a cross-sectional study, with a prospective approach, and was conducted in 2025 at the Clinic for Eye Diseases. The study included 415 patients with glaucoma. The mean age was 67.84±10.84 years. Binary logistic regression was used to analyze factors associated with cataract occurrence.

Cataract was registered in 192 (46.3%) patients. The results showed that age (OR=1.122; $p<0.001$) and diabetes ($p=0.045$) were statistically significant factors associated with the cataract occurrence. Gender, previous glaucoma surgery, and corticosteroid use did not show any statistically significant relationship. The area under the ROC curve was 0.765 ($p<0.001$), indicating good discriminative ability of the model.

Age and diabetes are significant factors associated with the occurrence of cataracts in patients with glaucoma.

Keywords: Cataract, glaucoma, risk factors, diabetes, logistic regression.

Introduction

Cataracts are characterized by the progressive opacification of the eye's natural crystalline lens and represent one of the leading causes of visual impairment and blindness worldwide. According to the World Health Organization, cataracts account for a substantial proportion of cases of preventable and reversible blindness [1].

Glaucoma represents a chronic progressive optic neuropathy characterized by gradual damage to the optic nerve and loss of visual field. It is estimated that the number of glaucoma patients worldwide is constantly increasing, especially in the elderly population [2].

Cataracts and glaucoma often coexist in older patients. Age, metabolic diseases such as diabetes, corticosteroid use, and certain surgical procedures are factors associated with an increased risk of developing cataracts [3].

Given the frequent co-occurrence of these conditions, it is essential to identify the factors that influence cataract development in patients with glaucoma to enhance diagnostic accuracy and optimize therapeutic management.

The aim of this study was to analyze the association between cataract and certain demographic and clinical parameters in patients with glaucoma.

The specific objectives were to determine the prevalence of cataract in patients with glaucoma, to analyze the influence of age on the cataract occurrence, to examine the association between diabetes and cataract, to assess the influence of gender on the occurrence of cataract, to analyze the association between glaucoma surgery and cataract and to assess the influence of corticosteroid therapy on the occurrence of cataract.

Material and methods

The research was designed as a cross-sectional study with a prospective approach and was conducted during 2025 at the Clinic for Eye Diseases.

The study included 415 patients with diagnosed glaucoma.

The mean age of the respondents was 67.84±10.84 years, with a range of 15 to 88 years.

Of the total number of patients:

- 227 (54.7%) were women
- 188 (45.3%) were men

Diabetes was recorded in 33 (8.0%) patients, while 382 (92.0%) did not have diabetes.

Previous glaucoma surgery was recorded in 116 (28.0%) patients, while 299 (72.0%) had not undergone surgery.

Cataract was diagnosed in 192 (46.3%) patients.

Only 6 (1.4%) patients were treated with corticosteroids.

Statistical analysis was performed in SPSS 21. Percentages of structure were determined for the attribute series. Age is shown as the mean value ± SD. Binary logistic regression was used for statistical analysis, with cataract as the dependent variable and age, gender, diabetes, glaucoma surgery, and corticosteroid use as independent variables. Statistical significance was set at $p < 0.05$.

Results

The values shown in Table 1 refer to the demographic and clinical parameters analyzed.

Table 1. Demographic and clinical parameters

Parameter	Категорија	n	%	Средна вредност ± SD)
Age (years)	–	–	–	67.84 ± 10.84
Gender	Women	227	54.7	–
	Men	188	45.3	–
Diabetes	No	382	92.0	–
	Yes	33	8.0	–
Glaucoma surgery	No	299	72.0	–
	Yes	116	28.0	–
Cataract	Not present	223	53.7	–
	Present	192	46.3	–
Corticosteroids	No	409	98.6	–
	Yes	6	1.4	–

Binary logistic regression analysis was applied to assess the impact of selected demographic and clinical parameters on cataract occurrence in glaucoma patients, with cataract as the dependent variable and age, gender, diabetes, previous glaucoma surgery, and corticosteroid therapy as independent variables.

The classification table results indicate that the model achieved an overall accuracy of 68.4% of the cases. The predictive accuracy was 70.9% for patients without cataracts and 65.6% for those with cataracts, suggesting a satisfactory capacity of the model to discriminate between the two groups (Table 2).

Table 2. The classification table

Observed			Predicted		
			Cataract		Percentage Correct
			Absent	Present	
Step 1	Cataract	Absent	158	65	70,9
		Present	66	126	65,6
	Overall Percentage				68,4

a. The cut value is ,500

The analysis of individual predictors revealed that age is any statistically significant predictor of cataract occurrence ($p<0.001$). The Odds ratio (OR=1.122) shows that with each year of age increase, the risk of cataract occurrence increases by about 12.2%, which is consistent with the known epidemiology of this disease.

Diabetes also shows any statistically significant association with cataract ($p=0.045$). The value of OR=0.411 indicates that patients without diabetes have a lower probability of cataract occurrence compared to patients with diabetes, which confirms the role of metabolic disorders in cataract development.

Regarding gender, the analysis did not show any statistically significant association with cataract occurrence ($p=0.549$), indicating that in the studied population, the risk is similar in men and women.

Also, previous glaucoma surgery did not prove to be a significant predictor ($p=0.629$), which may indicate that surgical treatment itself is not an independent factor for the cataract development in the studied sample.

Regarding corticosteroid use, no statistically significant association was found ($p=0.130$), although OR=4.786 suggests a possible increased risk. This result is likely due to the small number of patients treated with corticosteroids, which reduces the statistical power of the analysis.

The analysis of the ROC curve shows that the area under the curve (AUC) is 0.765 ($p<0.001$), indicating a good discriminative ability of the model in predicting the occurrence of cataracts (Figure 1).

Table 3. Logistic regression for cataract

Variable	B	SE	Wald	p	OR	95% CI
Age	0.115	0.015	61.936	<0.001	1.122	1.090–1.154
Gender	-0.135	0.224	0.359	0.549	0.874	0.563–1.357
Diabetes	-0.888	0.443	4.013	0.045	0.411	0.173–0.981
Glaucoma surgery	0.118	0.245	0.233	0.629	1.126	0.696–1.821
Corticosteroids	1.566	1.035	2.289	0.130	4.786	0.630–36.385

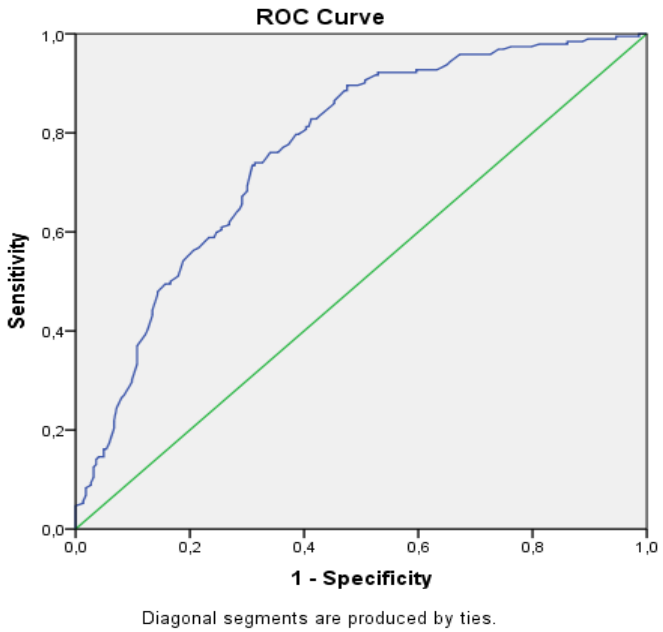

Figure 1. ROC curve

Discussion

This study analyzed the impact of several demographic and clinical parameters on the occurrence of cataract in patients with glaucoma using binary logistic regression. The results showed that age and diabetes were statistically significant predictors of cataract occurrence, while gender, previous glaucoma surgery, and corticosteroid use didn't show any statistically significant connection in the analyzed model. These findings are consistent with previous studies indicating that cataract in patients with glaucoma has a multifactorial etiology [3, 4].

It was found that age is the strongest predictor of cataract development. The results of logistic regression analysis showed that with each year of increasing age, the probability of developing cataracts increased. This result is consistent with the known pathophysiology of cataracts, as a degenerative disease associated with the aging process. Over time, oxidative damage and structural changes in proteins accumulate in the lens, leading to loss of lens transparency and cataract formation. A large number of population studies show that age is the most significant risk factor for this disease [4, 5].

Diabetes has also been shown to be a statistically significant factor associated with the occurrence of cataracts. It is known that chronic hyperglycemia in diabetic patients leads to metabolic changes in the lens, especially through activation of the polyol pathway and sorbitol accumulation. These osmotic changes lead to fluid retention in the lens and gradual structural damage, accelerating the development of cataracts. Several epidemiological studies confirm that patients with diabetes have a higher risk of cataracts and that the disease often occurs at a younger age in this group of patients [6, 7].

Regarding gender, this study found no statistically significant association with cataract occurrence. Although some studies indicate a slightly higher prevalence of cataracts in women, such differences are most often explained by the longer life expectancy of women and hormonal changes in the postmenopausal period [5].

Previous glaucoma surgery was not shown to be a significant independent factor for cataract development. Although it is known in clinical practice that some glaucoma surgical procedures can lead to faster cataract development, this association was not statistically confirmed in the analyzed sample. This finding is partially consistent with studies indicating that the risk depends on the type of surgical intervention and other associated factors [8, 9].

Corticosteroid use also shows no statistically significant association with cataract development in this study. However, the odds ratio value suggests a possible trend towards increased risk. This result is likely due to the small number of patients treated with

corticosteroids in the study group, which reduces the statistical power of the analysis. It is well documented in the literature that long-term use of corticosteroids can lead to cataract development [10, 11, 12, 13].

Additionally, ROC analysis showed that the logistic model has good discriminative ability in predicting cataract occurrence. The area under the ROC curve is 0.765, indicating a good model's ability to distinguish patients with cataract from those without. Although this value does not indicate a perfect model, it still demonstrates a solid predictive value of the analyzed parameters.

Overall, the results of this study indicate that cataract in glaucoma patients is a multifactorial condition, in which development, age, and systemic metabolic diseases such as diabetes play a significant role, being consistent with current findings in the literature [3,4].

Conclusion

The results of this study indicate that age and diabetes are significant factors associated with cataract development in patients with glaucoma. Gender, previous glaucoma surgery, and corticosteroid use did not show any statistically significant association. The logistic model showed moderate predictive power and good discriminative ability in predicting cataract development.

These results indicate the need for regular ophthalmological follow-up of patients with glaucoma, especially in older patients and those with diabetes.

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