

CORRELATION BETWEEN IRIS COLOR AND GLAUCOMA TYPE

POVEZANOST BOJE IRISA I TIPA GLAUKOMA

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Abstract

Introduction: Glaucoma is a group of diseases, etiologically very different, which is characterized by typical damage to the optic nerve and visual field defects. The most common cause of this disease is higher intraocular pressure (IOP) than the vascular system of the optic nerve head can withstand.

Aim: The aim of our study was to examine the correlation between iris color and glaucoma type through a cross-sectional study.

Material and methods: Total of 117 patients with glaucoma that were treated at the Clinic for Ophthalmology of the University Clinical Center of Serbia, in the glaucoma clinic, relevant data was recorded, including iris color and the type of glaucoma that was diagnosed and under therapy. The correlation between iris color and sex of patients, age, type of glaucoma, values of IOP of both eyes (IOP OD/OS) and central corneal thickness of both eyes (CCT OD/OS) was examined.

Results: The population of our patients consisted of 38.5% men and 61.5% women. Primary open angle glaucoma (POAG) was present in 34.2% and primary angle closure glaucoma (PCAG) in 28.2% of patients. Blue iris was found in 16.2%, green in 6.8%, light brown in 29.9% and dark brown in 47% of patients. The mean IOP is 17.6 ± 6.5 mmHg for the right and 16.9 ± 6.1 mmHg for the left eye, and for CCT 547.6 ± 69.3 μ m for the right and 546.6 ± 64.2 μ m for left eye. Statistically significant correlations were found between glaucoma type and sex ($p = 0.001$), glaucoma type and iris color ($p = 0.031$) and CCT and iris color ($p = 0.027$).

Conclusion: A statistically significant correlation of iris color and glaucoma type was confirmed, indicating that people with darker irises develop glaucoma more often than people with lighter irises. The relationship between sex and IOP with iris color was not determined. Results show a higher incidence of glaucoma in females, as well as higher values of CCT in people with darker irises.

Keywords:glaucoma,
iris color,
intraocular pressure,
central corneal thickness

Sažetak

Uvod: Glaukom predstavlja grupu oboljenja, etiološki veoma različitih, koja se karakteriše tipičnim oštećenjima očnog živca i ispadima u vidnom polju. Najčešći uzrok ovog oboljenja je viši očni pritisak (IOP) nego što vaskularni sistem papile očnog živca može da podnese.

Cilj: Cilj našeg istraživanja je da se kroz studiju preseka ispita povezanost između boje irisa i tipa glaukoma.

Materijal i metode: Kod 117 pacijenata sa glaukomom, lečenih na Klinici za očne bolesti Univerzitetskog kliničkog centra Srbije (UKCS), u ambulanti za glaukom, beleženi su relevantni podaci, prebojenost irisa i tip glaukoma koji je dijagnostikovao i pod terapijom. Ispitivani su povezanost boje dužice i pola pacijenata, starosti, tipa glaukoma, vrednosti intraokularnog pritiska oba oka (IOP OD/OS) i centralne debljine rožnjače oba oka (CCT OD/OS).

Rezultati: Populaciju naših ispitanika činilo je 38,5% muškaraca i 61,5% žena. Primarni glaukom otvorenog ugla (POAG) imalo je 34,2%, a primarni glaukom zatvorenog ugla (PCAG) 28,2% pacijenata. Plava boja dužice nađena je kod 16,2% pacijenata, zelena kod 6,8%, svetlosmeđa kod 29,9% i tamnosmeđa kod 47% pacijenata. Srednja vrednost IOP iznosi $17,6 \pm 6,5$ mm Hg za desno i $16,9 \pm 6,1$ mm Hg za levo oko, a za CCT $547,6 \pm 69,3$ μm za desno i $546,6 \pm 64,2$ μm za levo oko. Pokazane su statistički značajne korelacije između tipa glaukoma i pola ($p = 0,001$), tipa glaukoma i boje dužice ($p = 0,031$) i debljine rožnjače i boje dužice ($p = 0,027$).

Zaključak: Potvrđena je statistički značajna korelacija boje irisa i tipa glaukoma, koja ukazuje da se kod osoba sa tamnije prebojenim dužicama češće razvija glaukom nego kod osoba sa svetlijim. Nismo uspeli da utvrdimo povezanost pola i intraokularnog pritiska sa bojom dužice. Naši rezultati pokazuju veću učestalost glaukoma kod ženskog pola, kao i veće vrednosti centralne debljine rožnjače kod osoba sa tamnijim dužicama.

Ključne reči:

glaukom,
boja irisa,
intraokularni pritisak,
centralna debljina
rožnjače

Introduction

Glaucoma is a group of diseases, etiologically very different, which is characterized by typical damage to the optic nerve and visual field defects. The most common cause of this disease is higher intraocular pressure (IOP) than the vascular system of the papilla of the optic nerve can withstand. Glaucoma is a chronic progressive disease of the optic nerve whose frequency increases with age and amounts to 2.93% in people aged 40-80 years and as much as 10% in people over the age of 90 (1). This group of diseases is divided into primary glaucoma, which can be primary open angle glaucoma (POAG) and primary angle closure glaucoma (PACG), secondary and congenital glaucoma. Women are more likely to suffer from primary angle closure glaucoma, while there is no clear predilection for sex in primary open angle glaucoma (2).

The main risk factors are increased intraocular pressure (IOP), severe myopia and genetic predisposition. Measurement of IOP by applanation tonometry is an initial and mandatory diagnostic method, and IOP is currently the only risk factor that can be influenced in order to slow the progression of glaucoma. By lowering elevated IOP values from 21 to 32mmHg, it can reduce the five-year risk of developing POAG from 90.5% to 4.4% by 22.5% (1).

Central corneal thickness (CCT) can be a potential risk factor for the development and progression of glaucoma, since reduced corneal thickness affects the measurement of IOP, or underestimates pressure, and such CCT is a significant factor in the conversion of ocular

hypertension to glaucoma (1, 3).

The pathogenesis of the correlation between iris color and IOP remains yet unknown, but it has been found that people with darker colored irises have slightly higher IOP values than those with lighter ones (4). However, the results of the second study did not confirm that there is a significant association between these factors (3).

The aim of our study was to examine the association between iris color and glaucoma type through a cross-sectional study. In published studies on the correlation between iris color and ophthalmic parameters, data on intraocular pressure and central corneal thickness can be found. On the other hand, according to the literature review, we did not find any study that would address the goal we set in this study. Also, no relevant study of this type has been conducted in Serbia.

Material and methods

The research included 117 patients with a diagnosis of glaucoma, treated at the Clinic for Eye Diseases of the University Clinical Center of Serbia, in the glaucoma clinic, in the period from November 2020 to January 2021. The population consisted of 45 men (38.5%) and 72 women (61.5%), with an average age of 64.1 years (Table 1). All patients were older than 18 years.

Relevant data were recorded: demographic data (name and surname, date of birth and gender), iris color, type of glaucoma diagnosed and under therapy, values of IOP and CCT of both. Iris color was divided into 4 groups

Table 1. Baseline characteristics of patients with glaucoma

Characteristic	n (%)	
Number of patients	117 (100)	
Gender	Male	45 (38.5)
	Female	72 (61.5)
Age at the time of inclusion in the study	Arithmetic mean \pm SD	64.1 \pm 14.8
	Median (min-max)	68 (20-89)
Type of glaucoma	POAG	40 (34.2)
	PACG	33 (28.2)
	NTG	5 (4.3)
	PEX	23 (19.7)
	Pigmented	4 (3.4)
	Other	12 (10.3)
Type of other glaucoma	JUV	4 (3.4)
	MIX	4 (3.4)
	OH	4 (3.4)
Iris color	Blue	19 (16.2)
	Green	8 (6.8)
	Light brown	35 (29.9)
	Dark brown	55 (47.0)
Prostaglandins	0	67 (57.3)
	1	50 (42.7)
Surgery	0	100 (85.5)
	1	17 (14.5)

SD – Standard deviation; POAG – Primary open angle glaucoma; PCAG – Primary closed angle glaucoma; NTG – Normal tension glaucoma; PEX – Pseudoexfoliation glaucoma; JUV – Juvenile glaucoma; MIX – Mixed glaucoma; OH – Ocular hypertension

(blue, green, light and dark brown). The types of glaucoma that have been recorded are primary and secondary: POAG, PACG, normotensive glaucoma (NTG), pseudoexfoliative glaucoma (PEX), pigmented glaucoma and others (neovascular, lens-related, after vitrectomy, etc.). The values of IOP of both eyes were obtained with a Goldmann applanation tonometer on a previously locally anesthetized eye (Sol. Tetracaine 1% drops), while CCT values were measured by ultrasonic pachymetry (OcuScan RxP Ophthalmic Ultrasound System, Alcon Laboratories, Forth Worth, Tx) after the use of a local anesthetic in drops (Sol. Tetracaine 1%).

Statistical analysis

Descriptive statistical methods and methods for testing statistical hypotheses were used for the analysis of primary data. Out of the descriptive statistical methods, the measures arithmetic mean and standard deviation, median and range, as well as absolute and relative numbers were used. Among the methods for testing statistical hypotheses for numerical data, variance analysis (ANOVA), t-test and Mann-Whitney test depending on the number of groups and the normality of the data distribution were

used. The normality of the distribution was examined mathematically using the coefficient of variation and graphically by looking at the histogram. An exact probability test (Fisher’s test) was used to test statistical hypotheses for categorical data. Statistical hypotheses were tested at the level of statistical significance (alpha level) of 0.05. IBM SPSS v21 statistical software was used.

Results

Out of a total of 117 patients, 45 were male (38.5%) and 72 were female (61.5%). At the time of inclusion in the study, the age of the examined population was in the range of 20-89 years, with an average age of 64.1 \pm 14.8 years. The most common type of glaucoma was POAG with 34.2%, and PCAG in second place with 28.2%. Blue iris was found in 19 patients (16.2%), green in 8 (6.8%), light brown in 35 (29.9%) and dark brown in 55 patients (47%) (Table 1). There was no statistically significant correlation between iris color and sex ($p > 0.05$), while a statistically significant correlation was found between glaucoma type and sex ($p = 0.001$) (Figure 1). There is also a statistically significant correlation in the distribution of glaucoma type in relation to the color of the plank ($p = 0.031$), but this conclusion should be taken with a grain of salt due to the large number of categories (Figure 2).

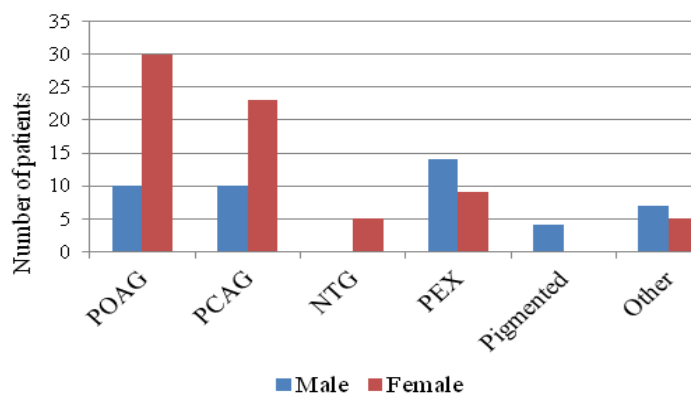


Figure 1. Gender-specific incidence of a particular type of glaucoma

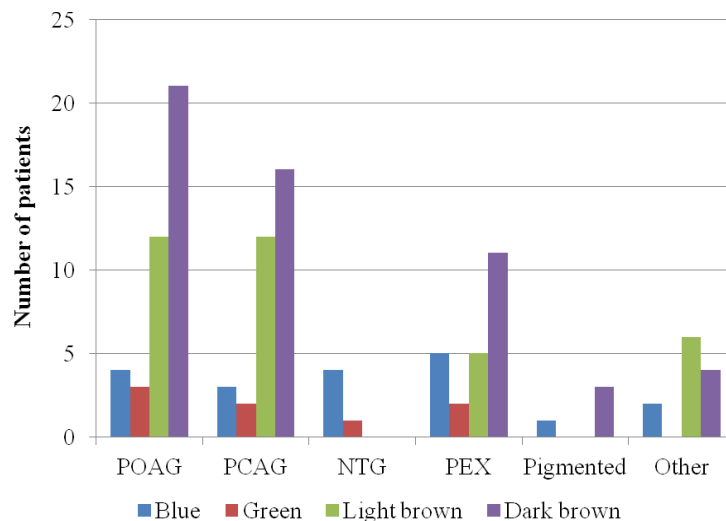


Figure 2. Frequency of iris color depending on the type of glaucoma

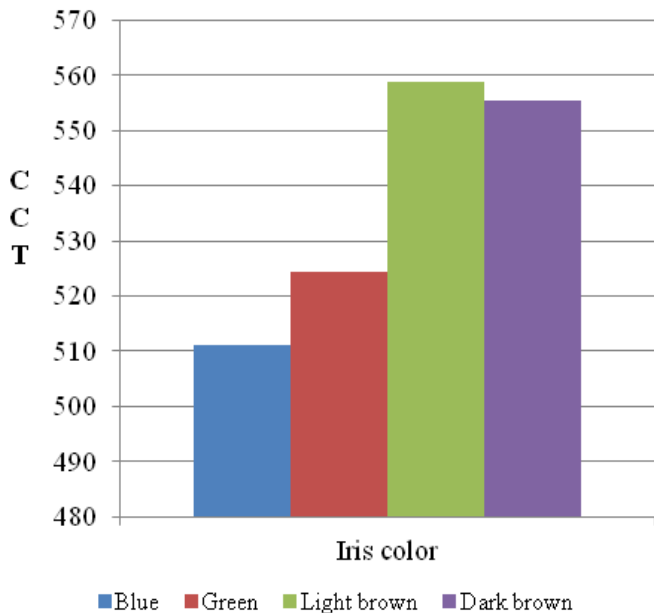


Figure 3. CCT depending on the iris color

The mean IOP is 17.6 ± 6.5 mmHg for the right eye and 16.9 ± 6.1 mmHg for the left eye. No statistically significant association was found between IOP and iris color ($p > 0.05$). The arithmetic mean for CCT is 547.6 ± 69.3 µm for the right eye and 546.6 ± 64.2 µm for the left eye. Statistical analysis showed a significant difference in the thickness of the cornea depending on the color of the iris ($p = 0.027$) (Figure 3).

Discussion

According to the literature review, one study reported that women were more likely to develop PCAG, without a clear predilection for gender in POAG, while the results of another study showed a higher incidence in men (1,2). In our study, an association between glaucoma type and gender was found, namely significantly higher prevalence of POAG, PCAG and NTG in females compared to males. The obtained results coincide with the data obtained at the Clinic for Ophthalmology of the University Medical Center “Zvezdara” with 63.8% representation in women (5). One of the reasons for this distribution is the longer life lifespan of women compared to men (2).

In particular, during the study, data was recorded on whether subjects possibly use eye drops that are known to change the color of the iris (prostaglandin analogues - used by 42.7% of subjects), with specifically asking patients if there was a significant change in iris color during the treatment, but none of the respondents stated that they noticed a significant change in the iris color.

According to a study by Katsara and Nothnagel (6), in the Balkan countries the most common color of iris is brown, less green, and the least blue with less than 10% (Figure 4). The results of our study also show a more significant representation of darker colored irises compared to lighter, with green being much less common than blue. In our study, the association between iris color and glaucoma type was examined. A statistically significant correlation

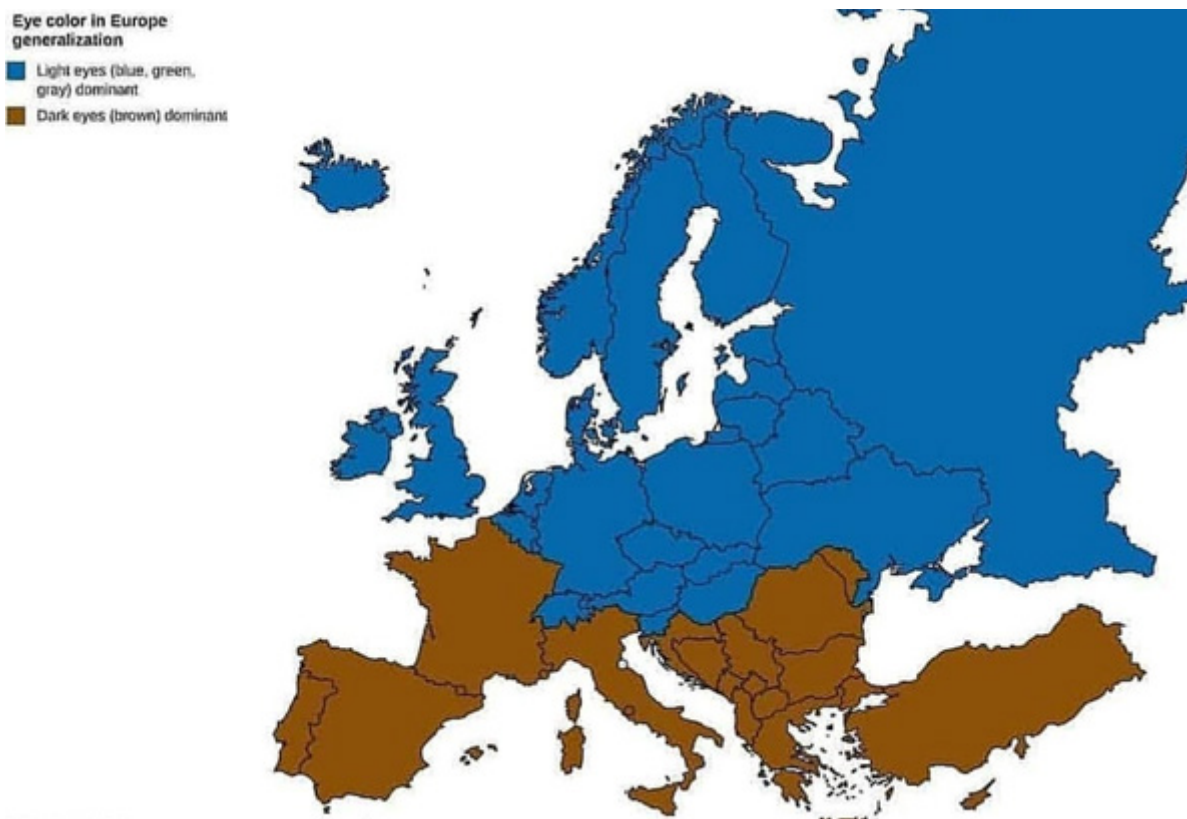


Figure 4. Distribution of eye color in Europe

between these parameters was found, which shows that people with darker colored irises, i.e. dark and light brown in color, more often suffer from glaucoma compared to people with lighter irises, i.e. green and blue, whose frequencies are almost equal. This difference in the prevalence of glaucoma does not refer to normotensive glaucoma, whose prevalence is uniform among iris staining. Based on the available literature data, so far no study has examined the correlation of these parameters, but their correlation should be taken doubtfully due to the large number of categories.

In one of the studies, a correlation was found between iris color and intraocular pressure, i.e. slightly higher IOP values were proved in people with darker colored irises (4). The results of our study contradict these findings, which have also not been proven by a study conducted in America (3).

By analyzing the data obtained in our study, a statistically significant association was observed between central corneal thickness and iris color. Higher values of CCT were found in people with darker irises, and due to the known influence of corneal thickness on the height of the IOP measured aplanally, its increased values are also obtained. However, according to the results of a study by Semes et al. (3), no significant correlation between these data has been demonstrated.

Conclusion

This is the first study in our region and in the world that examined the correlation between iris color and glaucoma type. A statistically significant correlation of the examined parameters was confirmed, which indicates that glaucoma develops more often in people with darker colored irises than in people with lighter ones, so based on the results of this limited number of respondents, it is believed that the iris color can be considered one of the determinants of glaucoma. The relationship between sex and intraocular pressure with the color of the iris was not determined. The results show a higher incidence of glaucoma in females, as well as higher values of central corneal thickness in persons with darker irises.

Literature

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