ORIGINAL ARTICLE

UDC: 617.7-007.681:616.89-008.454
DOI: https://doi.org/10.2298/VSP230831008C

Assessment of depression in patients with open-angle glaucoma

Procena depresije kod bolesnika sa glaukomom otvorenog ugla

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Abstract

Background/Aim. Depression can be caused by a life situation. The aim of the study was to determine the influence of glaucomatous damage on the frequency of occurrence of depression, as well as to determine the risk factors for the onset of depression in patients with open-angle glaucoma (OAG). **Methods.** The study was designed as a clinical, observational study (cross-sectional study). The research included 150 patients of both genders over the age of 40 with a confirmed diagnosis of OAG. Anamnestic and sociodemographic data were collected by a questionnaire and detailed ophthalmological examinations were performed. The Beck Depression Inventory-II scale was used as a measurement instrument to assess depression. **Results.** A high (51.3%) prevalence of depressive symptoms in patients with OAG was confirmed. The patients who suffered from depression more often were women, people with lower monthly earnings, and lower mean deviation values of the visual field index. In patients with advanced glaucoma, a significantly higher frequency of depressive symptoms was observed. **Conclusion.** Due to the high prevalence of depressive symptoms, it is important to introduce a multidisciplinary approach to treatment by ophthalmologists and psychiatrists. Detecting and treating depressive symptoms at an early stage of the disease leads to a significant reduction in treatment costs and patient disability.

Key words:
age factors; depression; glaucoma, open-angle; socioeconomic factors; risk factors; surveys and questionnaires.

Apstrakt

Uvod/Cilj. Depresija može biti izazvana nekom životnom situacijom. Cilj rada bio je da se utvrdi uticaj oštećenja izazvanog glaukomom na učestalost pojave depresije, kao i da se utvrde faktori rizika za nastanak depresije kod pacijenata sa glaukomom otvorenog ugla (GOU). **Metode.** Studija je dizajnirana kao klinička, opservaciona studija (studija preseka). Istraživanje je obuhvatilo 150 bolesnika oba pola, starijih od 40 godina, sa potvrđenom dijagnozom GOU. Obavljeni su detaljni oftalmološki pregledi, a anamnestički i sociodemografski podaci su prikupljeni putem upitnika. Kao instrument merenja za procenu depresije, korišćena je skala *Beck Depression Inventory-II*. **Rezultati.** Potvrđena je visoka (51,3%) prevalenca simptoma depresije kod bolesnika sa GOU. Od depresije su češće obolevale žene, osobe sa nižom mesečnom zaradom i nižim vrednostima srednje devijacije indeksa vidnog polja. Kod bolesnika sa uznapredovalim glaukomom, uočena je značajno viša učestalost simptoma depresije. **Zaključak.** Zbog visoke prevalencije simptoma depresije, važno je uvođenje multidisciplinarnog pristupa lečenju od strane oftalmologa i psihijatra. Otkrivanje i lečenje simptoma depresije u ranoj fazi bolesti dovodi do značajnog smanjenja troškova lečenja i onesposobljenosti bolesnika.

Ključne reči:
uzrast, faktor; depresija; glaukom, otvorenog ugla; socijalno-ekonomski faktori; faktori rizika; ankete i upitnici.

Introduction

Glaucoma is a chronic, progressive optic neuropathy that occurs as a result of the death of retinal ganglion cells and their axons. It is manifested by characteristic morphological changes in the optic nerve head and corresponding visual field defects (VFDs). Glaucoma is the leading cause of irreversible blindness around the world [1]. The prevalence of glaucoma is 3.54% in people aged 40–80 years [1–3]. Primary open-angle glaucoma (OAG) is the most common form of glaucoma worldwide [4].

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Depression can be genetic, with an imbalance of neuroactive substances. Yet, it can also be caused by a life situation. Previous studies have shown a relatively high prevalence of depression (10–57%) and anxiety (13–33%) among glaucoma patients (GPs) [5–7]. However, an Israeli study found similar rates of depression in GPs and the general population [8]. In recent Serbian clinical research, none of the investigated clinical ophthalmological characteristics emerged as risk factors for depression, but the following did: low economic status, poor health, presence of comorbidities such as cardiovascular diseases, history of surgeries, and non-beneficial lifestyle habits of GPs. These findings suggest that objective measures of glaucoma severity may not be as important to the mental health of GPs as their perception of illness and disability [9]. Research shows that depression and anxiety can be caused by being diagnosed with glaucoma due to the fear of potential blindness, sociodemographic factors, daily lifelong antiglaucoma therapy, or multiple surgeries [1, 3]. Evidence has shown that GPs often have problems with essential daily activities such as walking, driving, or reading, especially when perimetric damage is advanced or when both eyes are affected [2]. Moreover, they reported that VFDs were associated with greater depression. It has been previously published that VFDs were associated with a greater risk of a significant reduction in patients' daily activities. Both have been associated with depression [10]. DiMatteo et al. [11] have shown in their meta-analysis that adherence to medication therapy is worse in the treatment of various diseases in patients with depressive symptoms. Adherence was found to be 38 times lower in depressed patients compared to non-depressed Mexican GPs [12]. More recent research shows that GPs with poor compliance have more symptoms of depression compared to patients with good compliance [13]. Research shows that GPs on long-term topical therapy with β-blockers (BB) are at a higher risk of developing depressive disorders [14, 15].

The main aim of the study was to determine the impact of glaucomatous damage on the frequency of depression and to assess the risk factors for depression in patients with OAG.

Methods

The research was conducted according to the principle of a clinical observational study (cross-sectional study) [16].

The study was approved by the Ethics Committee of the University Clinical Center Kragujevac (No 01/18/3740 from September 25, 2018). All patients signed an informed consent before inclusion in the study. The research included 150 patients of both genders, ages over 40. All the patients had a confirmed OAG diagnosis and were treated at the Ophthalmology Clinic of the University Clinical Center in Kragujevac, Serbia. Patients diagnosed with primary OAG, pseudoexfoliative glaucoma (PEX), and pigmentary glaucoma (PIG), with at least one year from diagnosis, were included in the study. The criteria for exclusion from the study were pregnancy, breastfeeding, and the presence of other types of eye diseases (primary angle closure glaucoma, secondary glaucoma, senile macular degeneration, uveitis, diabetic maculopathy, corneal diseases, and cataracts except for initial nuclear condensations). Anamnestically obtained data on the presence of coexisting psychological conditions before diagnosis (anxiety/depression, psychosis), abuse of alcohol and narcotics, use of drugs that are known to affect the patient's cognitive abilities or mental state (digoxin, corticosteroids), simultaneous participation in clinical studies that involve testing drugs or medical devices upto 30 days before the research were also exclusionary factors.

The study did not exclude patients using topical BB or carbonic anhydrase inhibitors (CAI_s) due to the interest in investigating their effect on the occurrence of anxiety and depressive symptoms.

The ophthalmological examination included: determination of best-corrected visual acuity (VA) – BCVA according to Snellen, detailed examination on a biomicroscope, measurement of intraocular pressure (IOP) with a Goldmann applanation tonometer, gonioscopy, examination of the fundus (with a non-contact glass for fundus examination with sufficient magnification on a biomicroscope or direct contact glass for fundus examination on a biomicroscope), and standard automated perimetry (SAP). SAPwas performed on a Humprey apparatus (Carl Zeiss Meditec AG, Jena, Germany) program 30-2 or 24-2.

OAG was diagnosed based on optic disk appearance and VFD [17]. In the case of the presence of disease in both eyes, the patient was grouped based on the data from the eye showing the worse clinical findings, BCVA, and mean deviation (MD) of the visual field index. A minimum of one year of disease duration and a minimum of three perimetric findings of standard automatic perimetry were selected for reliable determination of disease stage. The severity of glaucoma was determined based on the perimetric findings and MD index values according to Hoddap's classification [18]. Based on the severity of the perimetric damage, the patients were divided into three groups of 50 patients each. The first groupconsisted of patients with an early stage of glaucoma [MD < 6 decibels (dB)], the second groupof patients was with a moderate stage of glaucoma (MD > 6 dB), and the third groupwas with an advanced stage of glaucoma (MD > 12 dB).

Sociodemographic data were obtained by filling out a questionnaire by the first researcher during a conversation with the patient at the ophthalmology clinic.

The questionnaire included age, gender, marital status (single/married/divorced/widowed), level of education (illiterate/primary/secondary/high), occupation, employment (employed/unemployed/retired), economic status (total monthly household income < 20,000, from 20,001 to 40,000, from 40,001 to 60,000, from 60,001 to 80,000, and > 80,000 Serbian dinars.

The Beck Depression Inventory-II (BDI-II) assessment scale was used in our study. It is one of the most widely used instruments for measuring the intensity and symptoms of depression in the clinical and general population, sufficiently sensitive and specific for diagnosing depression [19, 20]. In 2010, it was translated into Serbian and confirmed in our

population [20]. All patients were personally interviewed without paraphrasing by the first researcher during control examinations at the Ophthalmology Clinic of the University Clinical Center Kragujevac.

The BDI-II consists of 21 items, and the score can range from 0 to 63. Scores 0–9 indicate no depression, 10–16 indicate mild mood disorder, 17–20 indicate mild to moderate depression, 21–30 moderate depression, 31–40 severe depression, and over 40 indicate extreme depression.

Statistical data processing

The following descriptive statistical methods were used: measures of central tendency (arithmetic mean, median), measures of variability (standard deviation, range), and indicators of structure expressed as percentages. Correlation between variables in which the distribution of data was normal was examined using Pearson's rank correlation. It has a value between -1 and 1. The sign indicates the direction of correlation. The strength was determined according to the division proposed by Cohen [21] (1988): small 0.10–0.29, medium 0.30–0.49, and large 0.5–1.0. The Kruskal-Wallis test was used to compare different groups of glaucoma. The Mann-Whitney *U* test for continuous variables and Pearson's Chi-square test or Fisher's exact probability test for categorical variables were used to test the difference. Univariate logistic regression was used to analyze the impact of risk factors (sociodemographic, clinical characteristics) on the occurrence of depression. Statistically significant risk factors ($p < 0.05$) with the outcome in univariate analysis were then selected for multivariate logistic regression analysis. The results of the regression models have been presented as an odds ratio with a 95% confidence interval (CI). A value of $p < 0.05$ is considered statistically significant. All data were processed with the SPSS 20 statistical program.

Results

In the overall study sample, the mean age was 73.0 ± 10.5 years (range 42 to 98 years). The average age was 67.04 ± 10.40 years (range 42 to 88) in the groupwith early glaucoma, 76.22 ± 9.64 years (range 52 to 93) in the groupwith moderate glaucoma, and 75.78 ± 8.84 years (range 54 to 98) in the groupwith advanced glaucoma.

The largest number of patients [88 (58.7%)] were female. Early-stage glaucoma was present in 35 (70%) women. In the advanced stage group, the majority of patients were [28 (56%)] men. Out of the total of 150 patients, 103 (68.7%) were married; 80 (53.3%) patients had secondary education and 48 (32%) had high education. Most [107 (71.3%)] of the patients were retired; 24 (16%) patients had the lowest income (Table 1).

Table 1

Sociodemographic characteristics of patients with open-angle glaucoma (OAG)

Characteristics	Group			Total
	Early OAG MD < 6 dB	Moderate OAG MD < 12 dB	Advanced OAG MD > 12 dB	
Age, years	67.04 ± 10.4 (42–88)	76.22 ± 9.64 (52–93)	75.78 ± 8.84 (54–98)	73.01 ± 10.48 (42–98)
Gender				
male	15 (30)	19 (38)	28 (56)	62 (41.3)
female	35 (70)	31 (62)	22 (44)	88 (58.7)
Marital status				
single	0 (0)	0 (0)	1 (2)	1 (0.7)
married	40 (80)	31 (62)	32 (64)	103 (68.7)
widowed	4 (8)	15 (30)	13 (26)	32 (21.3)
divorced	4 (8)	15 (30)	13 (26)	32 (21.3)
Education				
basic	2 (4)	5 (10)	14 (28)	21 (14)
secondary	18 (36)	31 (62)	31 (62)	80 (53.3)
high	30 (60)	14 (28)	4 (8)	48 (32)
illiterate	0 (0)	0 (0)	1 (2)	1 (0.7)
Employment status				
employed	21 (42)	8 (16)	5 (10)	35 (22.7)
unemployed	0 (0)	1 (2)	8 (16)	9 (6)
pensioner	29 (58)	41 (82)	37 (74)	107 (71.3)
Monthly salary, Serbian dinars				
< 20,000	1 (2)	5 (10)	18 (36)	24 (16)
20,000–40,000	16 (32)	26 (52)	25 (50)	67 (44.7)
40,001–60,000	21 (42)	12 (24)	7 (14)	40 (26.7)
60,001–80,000	10 (20)	6 (12)	0 (0)	16 (10.7)
> 80,001	2 (4)	1 (2)	0 (0)	3 (2)

MD – mean deviation; dB – decibel. Number of patients = 50 in each group.

All values are expressed as numbers (percentages), except for age which is shown as mean ± standard deviation (range).

All patients had bilaterally developed disease. The BCVA of 150 patients with OAG in their worse-seeing eye was 0.61 ± 0.38 (range 0–1.0). The mean IOPin the worse eye was 19.61 ± 5.58 (range 10–50). The mean cupto disc ratio (C/D) value in the worse eye was 0.66 ± 0.26 (range 0.2–1.0). The average number of glaucoma surgeries performed was 0.12 ± 0.1 (range 0–2). The most performed surgery was argon laser trabeculoplasty (ALT) in ten patients, followed by trabeculectomy in eight patients (Table 2).

Some form of depressive symptoms was found in 77 (51.3%) patients. All seven patients with extreme depression had advanced-stage glaucoma (Table 3).

A high positive correlation was observed between the stage of glaucoma and the level of depression (Pearson's correlation coefficient +0.608).

The frequency of depression among three different groups of OAG, early glaucoma, moderate glaucoma, and advanced glaucoma, was statistically significant, $p = 0.002$. It shows that the severity of glaucoma affects the occurrence of depression (Table 3).

Table 2

Clinical characteristics of patients with open-angle glaucoma (OAG)

Clinical characteristics	Group			Total
	Early OAG MD < 6 dB	Moderate OAG MD < 12 dB	Advanced OAG MD > 12 dB	
BCVA, mean ± SD (range)				
worse eye	0.92 ± 0.12 (0.5–1.0)	0.74 ± 0.22 (0.3–1.0)	0.16 ± 0.24 (0–0.8)	0.61 ± 0.38 (0–1.0)
better eye	0.99 ± 0.03 (0.8–1.0)	0.89 ± 0.16 (05–1.0)	0.57 ± 0.28 (0–1.0)	0.69 ± 0.28 (0–1.0)
IOP, mean ± SD (range)				
worse eye	18.44 ± 4.3 (11–33)	18.28 ± 3.58 (11–28)	22.1 ± 7.33 (10–50)	19.61 ± 5.58 (10–50)
better eye	16.67 ± 2.9 (10–21)	16.86 ± 3.31 (10–22)	16.54 ± 4.68 (4–28)	16.69 ± 3.69 (4–28)
C/D, mean ± SD (range)				
worse eye	0.41 ± 0.11 (0.2–0.7)	0.63 ± 0.2 (0.2–1.0)	0.93 ± 0.11 (0.6–1.0)	0.66 ± 0.26 (0.2–1.0)
better eye	0.35 ± 0.09 (0.2–0.6)	0.5 ± 0.18 (0.2–0.9)	0.69 ± 0.22 (0.1–1.0)	0.51 ± 0.22 (0.1–1.0)
Laterality of the disease, n (%)				
bilateral	50 (100)	50 (100)	50 (100)	150 (100)
one-sided	0 (0)	0 (0)	0 (0)	0 (0)
Number of anti-glaucoma drops *per* eye, mean ± SD (range)	2.12 ± 1.39 (1–6)	2.38 ± 1.82 (1–12)	3.78 ± 2.0 (1–10)	2.76 ± 1.9 (1–12)
Anti-glaucoma eye drops, n				
prostaglandin analogues	35	41	28	104
β-adrenergic blockers	15	21	16	52
carbonic anhydrase inhibitors	11	12	34	57
α-2 selective adrenergic agonists	11	10	26	47
cholinergic agonists	1	0	3	4
Number of antiglaucoma operations, mean ± SD (range)	0.0 ± 0.0 (0–0)	0.16 ± 0.1 (0–2)	0.2 ± 0.1 (0–1)	0.12 ± 0.1 (0–2)
Kind of antiglaucoma operations, n				
argon laser trabeculoplasty	0	6	4	10
trabeculectomy	0	2	6	8

BCVA – best-corrected visual acuity; IOP– intraocular pressure; C/D – cupto disc ratio; SD – standard deviation; n – number. Number of patients = 50 in each group.

Table 3

Mental health of patients with open-angle glaucoma (OAG)

Depression (BDI) (points)	Early OAG 1º MD < 6 dB	Moderate OAG 2º MD < 12 dB	Advanced OAG 3º MD > 12 dB	*p*
Absent (0–9)	46 (92)	20 (40)	7 (14)	0.02
Mild mood disorder (10–16)	1 (2)	12 (24)	10 (20)	
Borderline (17–20)	2 (4)	6 (12)	3 (6)	
Moderate (31–30)	1 (2)	7 (14)	16 (32)	
Severe (31–40)	0 (0)	5 (10)	7 (14)	
Extreme (> 40)	0 (0)	0 (0)	7 (14)	

BDI – Beck Depression Inventory; MD – mean deviation. Kruskal Wallis test.

All values are expressed as numbers (percentages). Number of patients = 50 in each group.

The association of depression with sociodemographic and clinical characteristics of patients with OAG is presented in Table 4.

A significant association of depression with gender was observed in our study (p = 0.043), BCVA of the worse eye (p = 0.043), MD of the worse eye (p = 0.048), and C/D of the worse eye (p = 0.049). No statistical significance of the difference was obtained for the other variables.

Risk factors associated with depression in patients with OAG are presented in Table 5.

Table 4

Factors associated with depression in patients with open-angle glaucoma

Parameter	No depression (n = 73)	With depression (n = 77)	*p*
Age, years	72.04 (42–98)	74.04 (45–98)	0.33*
Gender, n (%)			
male	36 (49.3)	26 (33.8)	0.043**
female	37 (50.7)	51 (66.2)	
Marital status			
single	1 (1.4)	0 (0)	0.536**
married	47 (64.4)	56 (72.7)	
widowed	18 (24.7)	14 (18.2)	
divorced	7 (9.6)	7 (9.1)	
Education			
basic	11 (15.1)	10 (13)	0.120**
medium	44 (60.3)	36 (46.8)	
high	17 (23.3)	31 (40.3)	
illiterate	1 (1.4)	0 (0)	
Employment status			
employed	20 (26)	14 (16.5)	0.563**
unemployed	5 (6.5)	4 (5.5)	
pensioner	52 (67.5)	55 (75.3)	
Monthly salary, Serbian dinars			
< 20,000	10 (13)	14 (19.2)	0.122**
20,000–40,000	32 (41.6)	35 (47.9)	
40,001–60,000	20 (26)	20 (27.4)	
60,001–80,000	13 (16.9)	3 (4.1)	
> 80,001	2 (2.6)	1 (1.4)	
Best-corrected visual acuity			
worse eye	0.66 (0–1)	0.54 (0–1)	0.043*
better eye	0.84 (0–1)	0.79 (0.01–1)	0.283*
Intraocular pressure			
worse eye	19.51 (10–34)	19.71 (11–50)	0.320*
better eye	16.57 (4–23)	16.81 (8–28)	0.784*
Mean deviation			
worse eye	-8.47 (-28–10)	-10.41 (-28–10)	0.048*
better eye	-6.01 (-26– -0.06)	-6.53 (-28.4–0.84)	0.656*
Cupto disc ratio			
worse eye	0.617 (0.2–1)	0.699 (0.2–1)	0.049*
better eye	0.48 (0.2–1)	0.55 (0.1–1)	0.060*
Number of anti-glaucoma drops *per* eye	2.75 (1–10)	2.77 (1–12)	0.806*
Type of anti-glaucoma eye drops			
prostaglandin analogues	50 (26)	54 (74)	0.230**
β-adrenergic blockers	23 (26.7)	29 (39.7)	0.205**
carbonic anhydrase inhibitors	28 (36.4)	29 (39.7)	0.672**
α-2 selective adrenergic agonists	25 (32.5)	22 (30.1)	0.758**
cholinergic agonists	3 (3.9)	1 (1.4)	0.337**
Number of antiglaucoma operations	0.11 (0–2)	0.14 (0–1)	0.394*
Kind of antiglaucoma operation			
argon laser trabeculoplasty	4 (5.2)	6 (8.2)	0.753**
trabeculectomy	4 (5.2)	4 (5.2)	0.753**

***Mann-Whitney *U* test; **Pearson Chi-square test.**

Values are given as mean (range) or numbers (percentages).

Patients with OAG who suffered from depression more often were women (p = 0.044) and those who had lower monthly earnings (p = 0.028) and lower MD (p = 0.046). The chance of depression was 1.04 for advanced-stage glaucoma (MD > 12 dB), 0.597 for moderate-stage glaucoma (MD < 12 dB), and 0.495 for early-stage glaucoma (MD < 6 dB).

Multivariate logistic regression analysis showed that the MD in the worse eye was a clinically significant (p = 0.047) risk factor for depression, as well as monthly earnings (p = 0.030) (Table 6).

Table 5

Risk factors associated with depression in patients with open-angle glaucoma - univariate logistic regression

Parameter	Depression 95%			*p****
	odds	lower	upper	
Age, years				
< 55	0.083	0.003	2.046	
56–70	0.312	0.083	1.168	
71–85	1.397	0.594	3.284	0.184
≥ 86	0.333	0.04	2.769	
Gender				
male/female	0.688	0.361	1.308	0.044
Marital status				
[Δ]single				
married	0.808	0.371	1.758	0.576
widowed	0.750	0.184	3.057	
divorced	0.125	0.009	1.671	
Education				
basic	1.200	0.216	6.676	
medium	0.504	0.206	1.232	0.136
high	0.926	0.283	3.034	
[Δ]illiterate				
Employment status				
employed	0.500	0.125	1.999	
unemployed	1.500	0.106	21.312	0.291
pensioner	0.714	0.334	1.529	
Monthly salary, Serbian dinars				
< 20,000	6.000	0.859	41.902	
20,000–40,000	0.203	0.070	0.584	
40,001–60,000	1.222	0.353	4.235	0.028
60,001–80,000	0.429	0.031	5.985	
> 80,001	2.000	0.500	7.997	
Best-corrected visual acuity				
worse eye	0.682	0.271	1.745	0.153
better eye	1.394	0.352	6.308	0.716
Intraocular pressure				
worse eye	1.019	0.305	3.872	0.101
better eye	0.295	0.153	0.569	0.696
Mean deviation, dB				
< 6	0.495	0.153	1.606	
< 12	0.597	0.193	1.843	0.046
> 12	1.04	0.339	3.19	
Cupto disc ratio on the worse eye	0.536	0.208	1.993	0.380
Number of anti-glaucoma drops *per* eye	0.745	0.266	2.282	0.181
Type of anti-glaucoma eye drops				
prostaglandin analogues	0.540	0.248	1.177	0.233
β-adrenergic blockers	0.522	0.172	1.588	0.207
carbonic anhydrase inhibitors	0.929	0.328	2.628	0.674
α-2 selective adrenergic agonists	0.675	0.209	2.177	0.760
cholinergic agonists				0.340
Number of antiglaucoma operations	0.559	0.281	1.112	0.560
Kind of antiglaucoma operation				
there were no surgeries	0.541	0.271	1.079	
argon laser trabeculoplasty	6.000	0.354	101.568	0.793
trabeculectomy	6	0.221	162.53	

***** Analysis of variance.**

Note: Since there was only one patient who was single and one who was illiterate, they were excluded from the univariate analysis.

Table 6

Risk factors associated with depression in patients with open-angle glaucoma - multivariate logistic regression

Parameter	Depression 95%			*p*
	odds	lower	upper	
[Δ]Age	-	-	-	-
[Δ]Gender				
male/female	0.697	0.357	1.311	0.044
[Δ]Education	-	-	-	-
[Δ]Employment status	-	-	-	-
Monthly salary	0.673	0.471	0.962	0.030
[Δ] Best-corrected visual acuity				
worse eye	-	-	-	-
better eye	-	-	-	-
[Δ] Intraocular pressure				
worse eye	-	-	-	-
Mean deviation on the worse eye	1.5	1.006	2.239	0.047
[Δ]Cupto disc ratio on the worse eye	-	-	-	-
[Δ]Number of anti-glaucoma drops *per* eye	-	-	-	-

Note: [Δ]Data were excluded from multivariate logistic regression because their statistical significance was not determined in the univariate logistic regression.

Discussion

In our study, the prevalence of depressive symptoms in OAG patients was 51.3%. As glaucoma is a chronic disease, it has been the focus of many studies exploring depression. The prevalence of depression in Serbia among patients with diabetes mellitus is 16.7% [22], and among patients with rheumatoid arthritis, it is 42% [23]. In the recently published study by Serbian authors, depression was identified in 41% of GPs [9]. In a similar study conducted in Singapore, the prevalence of depression was 30%. The prevalence of depression in our patients is much higher than in Singapore [5].

Due to the difficulty of detecting depressive symptoms and preventing the occurrence of depression, in our research, we observed all patients with pronounced symptoms of depression as well as those with clinically significant depression. The cut-off score was > 9. According to data from the literature, the cut-off score for patients with clinically significant depression is > 20 [19, 20]. Clinically significant depression was experienced by 43 (28.67%) patients in OAG patients. In the groupof patients with early OAG, there was 1 (2%) patient with clinically significant depression, 12 (24%) were in the groupwith moderate OAG, and 30 (60%) were in the groupwith advanced OAG with clinically significant depression. Differences in prevalence can be attributed to different study designs. In Turkey, the depression occurrence among GPs was 57% [24], and in Australia, it was 19.09% [25]. In Hungary, 12.1% of GPs suffered from depression [26], and in America [27] and Japan [28], depression occurrence was registered in 10% of the population [9]. The lower prevalence of depression in America and Japan is explained by the earlier initiation of treatment, which prevents the progression of the disease and the emergence of psychiatric comorbidities. Depression was also found to affect 32.1% of patients with severe glaucomatous disease [14]. Our research showed that patients suffering from a more severe stage of glaucoma show a higher level of depression. This connection has been confirmed in other scientific works [6, 7].

Through research, we found that women, patients with lower monthly incomes, and lower MD values are more likely to suffer from depression, which is in line with the results of the connection between glaucoma and depression, shown by Stamatiou et al. [6]. The authors reviewed the literature (587 abstracts and 32 studies) and determined the connection between glaucoma and depression, while the advanced stage of the disease, older age, female gender, and faster progression of vision loss were recognized as potential risk factors for depression in GPs [6]. A low MD as a risk factor for depression indicates the importance of SAPin the evaluation of GPs.

Contrary to our results, in a recent Serbian study, none of the examined clinical ophthalmological characteristics appeared as a risk factor for depression. Like us, they confirmed that low economic status is a risk factor for depression in GPs. They also found that poor health, the presence of comorbidities such as cardiovascular diseases, a history of surgeries, and non-beneficial lifestyle habits like coffee consumption are the main risk factors for depression in GPs [9].

There was no statistically significant association between the use of topical BB and CAI_s and depression in our study group. In most studies, no effect of BB on depressive symptoms was observed [29]. There is data in the literature that BB and CAI_s inhibit monoamine anhydrase and worsen depressive symptoms [14]. By reviewing the literature and summarizing the cumulative published experience for a small part of those treated with topical BB, the neuropsychiatric spectrum that resolves after stopping the drug is mentioned as an adverse event [30]. Individual susceptibility cannot be ruled out, so clinicians should be cautious with patients who have had a positive personal or family history of depression [29].

The prognosis of blindness in GPs causes worries and fear of loss of independence, which increases the risk of developing anxiety and depression. Depression can be not

only a consequence but also a risk factor for the onset and worsening of glaucoma [4, 31, 32]. Furthermore, adherence is 38 times lower in GPs with depression compared to patients without depression, which increases the need for operative treatment [12].

Timely identification of the problem affects the course and prognosis of the glaucoma disease, adherence to medication therapy, and long-term improvement of the quality of life of GPs [33, 34]. Further research should determine the underlying pathophysiological mechanisms of the connection between glaucoma and depression [16].

Conclusion

A high (51.3%) prevalence of depressive symptoms in patients with OAG was confirmed. The patients who suffer from depression more often are women, patients with lower monthly earnings, and lower MD.

It is necessary that ophthalmologists understand the clinical importance of the multidisciplinary approach to GPs. Identifying and treating GPs with depressive disorders, as well as coordinating their therapy, is essential.

Acknowledgement

We would like to express our gratitude to M.Sc. Eng Marko Minić D.O.O. PRIZMA Kragujevac for technical support.

Conflict of interest

The authors declare no conflict of interest.

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Received on August 31, 2023
Revised on October 30, 2023
Revised on December 22, 2023
Accepted on January 9, 2024
Online First February 2024