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Quality of life of patients with primary open-angle glaucoma, primary angle closure glaucoma, and pseudoexfoliation glaucoma in Central Serbia

Kvalitet života bolesnika sa primarnim glaukomom otvorenog ugla, primarnim glaukomom zatvorenog ugla i pseudoeksfolijativnim glaukomom u centralnoj Srbiji

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Abstract

Background/Aim. Impaired vision resulting from glaucoma can have deleterious effects on both physical and mental health. This study aims to examine the adverse impacts of primary open-angle glaucoma (POAG), primary angle closure glaucoma (PACG), and pseudoexfoliation glaucoma (PEG) on the quality of life (QoL) in Central Serbia. **Methods.** This research, designed as a cross-sectional study, included 102 patients treated for POAG, PACG, or PEG. The patients were divided into three groups (POAG, PACG, and PEG) based on the type of glaucoma they suffered from and were monitored for six months. The data on the QoL were obtained with the National Eye Institute Visual Functioning Questionnaire 25 (NEI VFQ-25). Using the appropriate algorithm, the total NEI VFQ-25 scores were calculated for each group. **Results.** The questionnaire showed that scores for general vision were significantly lower in the PEG group than in the other two groups (PEG: 61.1 ± 12.6; POAG: 71.6 ± 17.9; PACG: 75.7 ± 11.6), $p < 0.001$. General health, eye pain, distance vision, social functioning, peripheral vision, reduced ability in daily activities, and dependence on others were also statistically significantly lower in the PEG group. The highest value of near vision was recorded for the POAG group (76.2 ± 21.2). The highest mean value in glaucomatous visual field defect was recorded in the PEG group (14.5 ± 3.6 dB). **Conclusion.** This research has demonstrated that the QoL is significantly lower in patients suffering from PEG compared to those suffering from POAG and PACG. Concerning the general health of patients, eye pain, distance vision, as well as the domain of social and everyday functioning, the lowest scores for individual areas of examination according to the NEI VFQ-25 were recorded in PEG patients. The results indicate that serious measures should be taken in order to improve the QoL of glaucoma patients.

Key words:
glaucoma, open-angle; glaucoma, angle-closure; exfoliation syndrome; quality of life; surveys and questionnaires.

Apstrakt

Uvod/Cilj. Oštećenje vida uzrokovano glaukomom ima snažan negativan uticaj na mentalno i fizičko zdravlje. Cilj studije bio je da se ispita uticaj primarnog glaukoma otvorenog ugla (PGOU), primarnog glaukoma zatvorenog ugla (PGZU) i pseudoeksfolijativnog glaukoma (PEG) na kvalitet života (KŽ) bolesnika u centralnoj Srbiji. **Metode.** U ovoj studiji preseka bila su uključena 102 bolesnika koji su lečeni zbog PGOU, PGZU ili PEG. Bolesnici su bili podeljeni u tri grupe (PGOU, PGZU i PEG) u zavisnosti od tipa glaukoma i posmatrani su šest meseci. Podaci o KŽ učesnika prikupljeni su korišćenjem upitnika *National Eye Institute Visual Functioning Questionnaire 25* (NEI VFQ-25). Korišćenjem odgovarajućeg algoritma izračunat je ukupan rezultat iz upitnika NEI VFQ-25 za svaku grupu. **Rezultati.** Parametri funkcije vida bili su statistički značajno niži u PEG grupi u poređenju sa ostalim

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ispitivanim grupama (PEG: 61,1 ± 12,6; PGOU: 71,6 ± 17,9; PGZU: 75,7 ± 11,6), $p < 0,001$. Opšte zdravlje, bol u očima, vid na daljinu, socijalno funkcionisanje, periferni vid, smanjena sposobnost u svakodnevnim aktivnostima i zavisnost od drugih, takođe su bili statistički značajno niži u PEG grupi. Najbolja oštrina vida na blizinu izmerena je u PGOU grupi (76,2 ± 21,2). Najviša srednja vrednost glaukomnog ispada vidnog polja zabeležena je u PEG grupi bolesnika (14,5 ± 3,6 dB). **Zaključak.** Istraživanje je pokazalo da su bolesnici sa PEG imali statistički značajno lošiji KŽ u poređenju sa bolesnicima koji su bolovali od PGOU i PGZU. Najniži skor po pojedinim oblastima ispitivanja po upitniku NEI VFQ-25 bio je kod bolesnika sa PEG, kada je u pitanju bilo opšte zdravlje bolesnika, osećaj bola u očima, vid na daljinu, kao i u domenu socijalnog i svakodnevnog funkcionisanja. Dobijeni rezultati ukazuju da treba preduzeti ozbiljne mere za popravljanje kvaliteta života bolesnika sa glaukomom.

Ključne reči:
glaukom, otvorenog ugla; glaukom, zatvorenog ugla; eksfolijativni sindrom; kvalitet života; ankete i upitnici.

Introduction

Glaucoma is a chronic and progressive optic neuropathy characterized by specific morphological changes in the head of the optic nerve and the retinal nerve fibers layer [1]. The defects of a visual field, which are the major clinical signs of glaucoma, result from the fiber loss in the retinal nerve. The most dominant risk factor for developing glaucoma is elevated intraocular pressure (IOP), i.e., ocular hypertension. However, there are also glaucoma patients with IOP measurements constantly lower than 21mmHg (so-called normal tension glaucoma) [2]. After cataracts, glaucoma is the second most common cause of blindness worldwide, but unlike a cataract, blindness caused by glaucoma is irreversible [3]. The global prevalence of glaucoma has been increasing. Reportedly, there were almost 80 million people with glaucoma in 2020, and 11 million of them were affected by irreversible blindness [4]. There are numerous classifications of glaucoma. Based on the mechanism of its development, glaucoma can be classified as primary, secondary, and congenital glaucoma [5]. In primary glaucoma, there is no association between glaucoma and any ophthalmic or systemic disease. Primary glaucoma is more likely to occur bilaterally [2]. On the other hand, secondary glaucoma results from another disease, and unlike primary glaucoma, more commonly manifests unilaterally [6]. The most frequent secondary glaucomas include pseudoexfoliative, pigmentary, uveitic, post-traumatic, and iatrogenic glaucoma. Congenital glaucoma is a rare condition with an incidence of 1 in 10,000 newborns. It stems from the developmental disorders of the iridocorneal angle [7]. Based on the status of the iridocorneal angle, i.e., its width, glaucoma can be classified as open-angle or angle-closure glaucoma [8]. Open-angle glaucoma is associated with abnormalities of the trabecular meshwork, which hinder the outflow of aqueous humor outflow. In angle-closure glaucoma, both primary and secondary, the closure of the iridocorneal angle occurs due to iridotrabecular contact (ITC). As a rule, in angle-closure glaucoma, the clinical symptoms are more pronounced, and IOP is more elevated [9]. Despite very dramatic clinical signs, this type of glaucoma can be pretty successfully treated with Yttrium aluminum garnet laser iridotomy, which most commonly leaves patients only with early-stage difficulties with near vision [9]. The diagnosis of glaucoma can be made with certainty only after taking IOP (tonometry), examining the width of the iridocorneal angle (gonioscopy), examining the head of the optic nerve (ophthalmoscopy), and performing a visual field testing (perimetry) [10]. Glaucoma treatments focus on lowering IOP levels, improving the circulation of the optic nerve head, and enhancing neuroprotection [1]. The reduction of elevated IOP is still the most effective method of glaucoma treatment, and it can be accomplished with anti-glaucoma drugs, laser therapy, and surgical procedures [11].

This study aims to examine the adverse impacts of primary open-angle glaucoma (POAG), primary angle closure glaucoma (PACG), and pseudoexfoliation glaucoma (PEG) on the quality of life (QoL). Countries differ in their cultural, economic, social, educational, and habituation characteristics. All these factors may be relevant for the QoL of glaucoma patients. Even within the same country, the regional differences vary significantly. To the best of our knowledge, no study comparing the QoL of patients with these three types of glaucoma has been conducted in the administrative district of Central Serbia. In addition to the general questionnaire inquiring about the demographic characteristics of the participants, this study used the National Eye Institute Visual Functioning Questionnaire 25 (NEI VFQ-25) as the main research instrument for gathering data on the QoL of the patients. NEI VFQ-25 was founded by the United States National Eye Institute (Bethesda, Maryland) in 1969. Since 1996, no further written permission has been needed for the usage of NEI VFQ-25. A final version of NEI VFQ-25 was adapted in 2000 [12]. This questionnaire is a reliable, standardized instrument for evaluating vision-dependent functions and the impacts of impaired vision on the QoL of patients suffering from a wide variety of ophthalmic diseases, including glaucoma. The initial version of the NEI VFQ-25 included 51 items. The questionnaire was later simplified and abbreviated, and its 25-item form was validated. The questionnaire uses a five-point Likert-type scale, so patients need to choose one from five provided answers. The questions cover 12 domains: general health, general vision, eye pain, near vision, distance vision, social functioning, mental health, disabilities, dependence on others, driving, color vision, and peripheral vision. The validation of the questionnaire was carried out in accordance with the cultural norms of the Serbian context in the same manner as in the study by Kovač et al. [13].

Methods

The study was conducted at the Clinic for Ophthalmology, University Clinical Center Kragujevac,

Serbia, from January to June 2022. The research was approved by the Ethics Committee of the University Clinical Center Kragujevac (No. 01/20-12323). According to the tenets of the Declaration of Helsinki, all patients gave their written consent at the beginning of the study.

The research was designed as a cross-sectional, randomized study. It included 102 participants suffering from POAG, PACG, or PEG who were treated in the outdoor unit of the Clinic. The patients visited the outdoor unit for their regular check-ups. The main inclusion criterion was the presence of one of these three types of glaucoma. They were equally divided into three groups (POAG, PACG, and PEG), depending on the type of glaucoma they suffered from. The study included only the patients treated for less than three years because, with longer treatments, it was ambiguous whether the low QoL was associated with the duration of their treatment, specific glaucoma they suffered from, or both.

The excluding criteria were: age below 18, the duration of the glaucoma treatment of more than three years, the presence of neuromuscular diseases or dementia, and pregnancy or breastfeeding. The other excluded groups included: the patients with other types of glaucoma (such as normal tension glaucoma and ocular hypertension), the patients treated for retinal diseases, optic neuropathy, ocular injuries, and the patients with a history of ocular surgeries or inflammation.

The glaucoma diagnoses were established after having determined that, in addition to the detected visual-field defects and elevated IOP levels (above 21 mmHg), the specific glaucomatous damage of the optic nerve head was recorded, i.e., the cup/disc ratio was above 0.3, there was neuroretinal rim thinning, and the asymmetry of a cup/disc ratio was larger than 0.2 between the eyes. The type of glaucoma was determined with a slit-lamp examination and gonioscopy. A wide and open iridocorneal angle was detected in the POAG patients. Angle-closure was defined based on the presence of ITC. ITC of more than 180 degrees was considered clinically relevant. Angle closure may result in raised IOP which may lead to glaucomatous optic neuropathy. In the patients with PEG, the iridocorneal angle was widely open. We also detected increased pigmentation. Finally, we detected the typical fibrillar deposits at the iris pupillary margins and the anterior lens capsules with slit lamp examination of the maximal mydriasis [14].

At the beginning of the study, the patients had to undergo a complete ophthalmological examination: visual acuity measurements, slit-lamp and funduscopic examinations, IOP measurements (taken with Goldmann applanation tonometer), gonioscopy, and standard automated perimetry (Humphrey visual field analyzer, Carl Zeiss, Oberkochen, Germany). According to Hodapp's classification, glaucoma patients were staged according to mean deviation (MD) value into early glaucomatous loss ≤ 6 decibels (dB), moderate glaucomatous loss 6 > MD ≤ 12 dB, and advanced glaucomatous loss MD > 12 dB [15]. All respondents were asked to fill in an NEI VFQ-25 questionnaire [13]. The questionnaire uses a five-point Likert-type scale; hence the patients need to choose one out of five provided answers. Each question/statement was converted into a scale ranging from 0 to 100. The appropriate algorithm was further used to calculate the total scores for the three groups. Every answer above 0 was graded with an additional 25 points; therefore, 0 was the lowest and 100 the highest possible score. The scores for each group were converted into the mean values with the standard deviation, minimum, and maximum values. The Machado et al. [16] study used a statistical program to conduct the G-power binomial test (binomial test, one sample case) aiming to examine the effects of visual acuity in the less impaired eye of the patients with POAG and their QoL. This study selected the probability of error of the first type $\alpha = 0.05$, the assumed minimum study power of 80% (0.8), and the effect size of 0.25. It identified a coefficient of determination of approximately 20% in a multiple linear regression model. We used a similar research instrument. With identical parameters, we calculated that at least 30 patients *per* group were needed to examine the impact of glaucoma type on QoL with a reasonable degree of probability. The Chi-squared (χ^2) test was used to compare differences in the frequency of categorical variables. The relationships between the dependent variable and the set of independent variables were examined with univariate and multivariate logistic regression. A value of $p < 0.05$ was considered to be statistically significant. All statistical calculations were performed in the standard SPSS software package, version 24.0. (The Statistical Package for Social Sciences software Inc, version 24.0, Chicago, IL).

Results

The mean age of the patients was 71.2 years. The highest mean value of the QoL questionnaire was recorded in the PEG group, followed by the PACG and the POAG groups (Table 1). However, the difference between the groups was not statistically significant ($p > 0.05$). Fifty-eight females and forty-four males participated in the study. The male/female ratio was not statistically significant either for the groups observed independently or in total ($p > 0.05$) (Table 1).

Table 1

Patient age and gender distribution

Characteristics	Groups			Total (n = 102)
	POAG	PACG	PEG	
Age, years				
mean ± SD	73.5 ± 6.2	68.5 ± 6.9	74 ± 5.8	71.2 ± 6.8
range, min-max	55–81 (69–76)*	52–81 (63–73)*	59–84 (72–77)*	52–84
Gender				
male/female, n (%)	15/19 (44.1/55.9)	14/20 (41.2/58.8)	15/19 (44.1/55.9)	44/58 (43.1/56.9)

POAG – primary open-angle glaucoma; PACG – primary angle closure glaucoma; PEG – pseudoexfoliation glaucoma; SD – standard deviation.

***The age range of the highest percentage of patients in the group.**

The lowest level of general health was recorded in the PEG group, followed by the POAG group. The PEG group was the most diverse in terms of general health (49.5 ± 25.1) with respect to other groups (POAG group: p <0.05; PACG group: $p < 0.001$). The average score for all three groups was 59.9 ± 22.0. The general vision of the PEG group was also significantly lower (PEG group: 61.1 ± 12.6; POAG group: 71.6 ± 17.9; PACG group: 75.7 ± 11.6), $p < 0.001$. The average score for all three groups was 69.4 ± 14.0. Eye pain was present more often in the PEG group (64.2 ± 17.6), in comparison to the groups with POAG (75.3 ± 24.5) and PACG (71.6 ± 21.0), $p < 0.05$. The average score for all three groups was 70.4 ± 21.1. Near vision was significantly better in the patients with POAG (76.2 ± 21.2), compared to the PACG (67.2 ± 18.8) and the PEG (62.1 ± 21.4) patients, $p < 0.05$. The average score for all three groups was 68.5 ± 20.5. Distance vision was significantly lower in the patients with PEG (61.2 ± 11.2) in comparison to the patients with PACG (81.4 ± 11.4) and POAG (76.4 ± 9.8), $p < 0.05$. The average score for all three groups was 73.0 ± 10.8. The difference between the latter two groups was not statistically significant, $p > 0.05$. Social functioning was hindered in the patients with PEG (82.2 ± 19.3) in comparison to the other two groups (POAG: 96.3 ± 6.8; PACG: 95.3 ±7.9), $p < 0.05$. The average score for all three groups was 91.3 ± 11.33. The patients with PEG (75.5 ±17.4) reported significantly lower levels of mental health (POAG patients: 93.5 ± 12.2; PACG patients: 92.5 ± 9.9), $p < 0.05$. The difference between the latter two groups was not statistically significant, $p > 0.05$. The average score for all three groups was 87.2 ± 13.2. The disability in daily activities was significantly lower in the PEG (63.4 ± 21.5) group than in the other two groups (POAG group: 90.8 ± 16.5; PACG group: 89.1 ± 19.3), $p < 0.001$. There were no significant differences between the latter two groups, $p > 0.05$. The average score for all three groups was 81.1 ± 19.1. The patients with PEG (82.3 ± 22.8) were more dependent on other people than the POAG (97.4 ± 13.3) and PACG patients (98.7 ±11.4), $p < 0.05$. The average score for all three groups was 92.8 ± 15.8. Lower vision abilities in the PEG patients and low general health made driving significantly more difficult for the PEG (49.4 ± 21.5) patients than for the POAG (87.3 ±17.3) and PACG (88.9 ± 14.6) patients, $p < 0.001$; there was no significant difference between the latter two groups, $p > 0.05$. The average score for all three groups was 75.2 ± 17.8. Our findings indicate that there was no statistically significant difference in color vision among the three groups (POAG: 100.0 ± 0.0; PACG: 100.0 ± 0.0; PEG: 94.2 ±16.7), while the average score for all three groups was 98.1 ± 5.6. Peripheral vision was more disturbed in the PEG (56.8 ± 21.7) group in comparison to the POAG (95.3 ± 5.2) and PACG (97.8 ±14.5) groups, $p < 0.001$. The average score for all three groups was 83.3 ± 13.8. The total score for the NEI VFQ-25 questionnaire was lower in the PEG (66.8 ± 19.1) patients (highly statistically significant) in comparison to the POAG (85.1 ± 13.7) and PACG (85.6 ± 13.5) patients, p <0.001, while the average score for all three groups was 79.2 ± 15.4 (Table 2).

Table 2

Scores of the NEIVFQ-25 questionnaire for the groups

Domains	Groups			All participants
	POAG	PACG	PEG	
General health	61.32 ± 19.34	68.82 ± 21.56	49.48 ± 25.12 $p < 0.001^a$, $p < 0.05^b$	59.87 ± 22.0
General vision	71.65 ± 17.86	75.67 ± 11.65	61.10 ± 12.57 $p < 0.001^{a,b}$	69.44 ± 14.02
Eye pain	75.35 ± 24.54	71.61 ± 21.04	64.17 ± 17.61 $p < 0.05^a$	70.37 ± 21.06
Near vision	76.24 ± 21.17	67.25 ± 18.83 $p < 0.05^a$	62.11 ± 21.43 $p < 0.05^a$	68.53 ± 20.48
Distance vision	76.45 ± 9.83	81.45 ± 11.38	61.18 ± 11.24 $p < 0.05^{a,b}$	73.02 ± 10.82
Social functioning	96.29 ± 6.79	95.34 ± 7.92	82.16 ± 19.32 $p < 0.05^{a,b}$	91.26 ± 11.34
Mental health	93.54 ± 12.22	92.48 ± 9.97	75.53 ± 17.38 $p < 0.05^{a,b}$	87.18 ± 13.19
Disability	90.82 ±16.47	89.12 ± 19.27	63.43 ± 21.48 $p < 0.001^{a,b}$	81.12 ± 19.07
Dependence on others	97.36 ±13.29	98.71 ± 11.42	82.34 ± 22.81 $p < 0.05^{a,b}$	92.8 ± 15.84
Driving	87.27 ± 17.28	88.86 ± 14.57	49.36 ± 21.52 $p < 0.001^{a,b}$	75.16 ± 17.79
Color vision	100.00 ± 0.00	100.00 ± 0.00	94.23 ±16.71 $p > 0.05$	98.07 ± 5.58
Peripheral vision	95.27 ± 5.17	97.81 ± 14.49	56.75 ± 21.72 $p < 0.001^{a,b}$	83.28 ± 13.79
Total	85.13 ± 13.66	85.59 ± 13.51	66.82 ± 19.08 $p < 0.001^{a,b}$	79.18 ± 15.42

NEI VFQ-25 – National Eye Institute Visual Functioning Questionnaire 25.
For abbreviations of other terms, see Table 1.
All results are shown as mean ± standard deviation. [a] – *p*-value vs. POAG group; [b] – *p*-value vs. PACG group.

Table 3

The influence of different glaucoma stages on the quality of life

Glaucoma stage/type	Early stage		Moderate stage		Advanced stage	
	MD (dB)	NEI VFQ-25 score	MD (dB)	NEI VFQ-25 score	MD (dB)	NEI VFQ-25 score
POAG	3.8 ± 1.0	88.1 ± 16.6	7.5 ± 2.1	84.2 ± 11.7	12.8 ± 3.2	81.3 ± 10.5
PACG	3.7 ± 1.1	89.2 ± 11.9	6.9 ± 2.3	86.4 ± 12.9	12.4 ± 2.8	83.1 ± 14.0
PEG	4.0 ± 1.2	70.2 ± 15.6	8.8 ± 1.8	68.5 ± 19.3	14.5 ± 3.6	64.7 ± 17.1
p	> 0.05	< 0.05	> 0.05	< 0.05	> 0.05	< 0.05

MD – mean deviation value; NEI VFQ-25 – National Eye Institute Visual Functioning Questionnaire 25. For abbreviations of other terms, see Table 1. All results are shown as mean ± standard deviation.

Table 3 shows the influence of different glaucoma stages on the QoL in all groups. The lowest NEI VFQ-25 score was recorded in the PEG group in all three stages. These values were significantly lower compared to POAG and PACG ($p < 0.05$). The differences between POAG and PACG were not statistically significant ($p > 0.05$). The highest mean value in glaucomatous visual field defect was recorded in the PEG group (14.5 ± 3.6 dB), while the patients with PACG had the lowest visual field defects in all three stages of glaucoma progression, but these results were not significant compared to the other two groups.

Discussion

As defined by the World Health Organization, health is "a state of complete physical, mental, and social well-being, not only the absence of a disease" [17]. Visual impairments caused by glaucoma or other ophthalmological diseases have strong adverse impacts on mental and physical health [18]. As patients' life expectancy has increased over time, the number of comorbidities has also increased, including the diseases that lead to visual impairments. Therefore, the QoL of glaucoma patients should be observed as a crucial element of any treatment. Glaucoma does not only lead to vision disturbances, but it also affects many aspects of patients' QoL [19]. Many studies suggest that advanced stages of glaucoma disease, with intensive visual field defects, are strongly associated with anxiety and depression [20, 21]. Likewise, patients' perception of the nature of the disease and the therapeutic treatments – medication, laser, or surgery – affects the QoL. In the end, glaucoma patients with impaired vision are more likely to suffer injuries while performing basic life activities, such as walking, eating, reading, and driving [22].

In this study, the patients were divided into three groups based on the glaucoma type they suffered from. Our results indicate that these three groups do not differ in age or gender. These findings are in line with the results obtained by some other studies [23, 24]. PEG is very difficult to control, regardless of the type of applied therapy. The disease, which includes high IOP levels on a daily basis, has an unpredictable course and faster progression [25]. Patients with PEG also have associated cardiovascular and cerebrovascular comorbidities more often and disturbed circulation in the optic nerve head. We recorded a significantly higher incidence of cerebrovascular diseases in the PEG group. That requires a greater number of medications to be used daily and, thus, can be associated with lower compliance rates. In addition, more comorbidities result in more financial strain because more medications must be bought. Since glaucoma patients are mainly pension users, very frequently they cannot afford all the medications they need or find them expensive. This *circulus vitiosus* can lead to decreased compliance rates and subsequent disease progressions [26, 27]. In developing countries, low income disturbs the QoL of older people significantly. There are incentives for some prescribed medicines for both systemic diseases and antiglaucomatous eye drops. However, a lot of patients choose to take only a proportion of the prescribed therapy, if any. Such patients usually live in rural areas and are not adequately informed about glaucoma and its potential complications. Since glaucoma is frequently asymptomatic, many patients believe that there is no need to take the prescribed therapy because no complications are expected. Even though it seemed less important, the financial status can have a huge influence on the QoL of patients treating glaucoma in our country. In developed countries, pensions are higher, and there are more incentives and programs available for the elderly.

Our findings indicate that there is a big discrepancy between the groups in terms of ocular pain. The patients with PEG stand out in terms of pain struggle. The ocular pain may be attributed to the number of antiglaucoma eye drops used by this group (more than one medication and more than one application per day), which is higher than for other groups. Namely, ocular pain stems from one of the side effects of benzalkonium chloride present in almost all antiglaucoma eye drops [28]. Benzalkonium chloride disturbs corneal and conjunctival epithelial cells, causing tear film instability and consequently ocular surface disease (OSD) [29]. OSD is more frequent in patients with pseudoexfoliations (PEX) because PEX affects conjunctival goblet cells [30]. These cells are responsible for producing the mucin layer of the tear film. Thus, PEX also leads to the development of dry eye that patients experience as discomfort and ocular pain [31]. Most patients subjectively described that feeling as a foreign-body sensation rather than pain. Only the patients who had acute glaucoma attacks had experienced real pain.

It is well known that vision could be highly impaired in patients with glaucoma [19]. Our findings indicate a difference in the degree of vision impairment in different glaucoma types. The PEG patients reported significantly lower general vision, as well as near and distance vision. These findings are similar to some previous studies [32–34]. In patients with PEX,

the progression of the disease is faster. It is also associated with cerebrovascular diseases and also leads more commonly to cataracts. It is also very interesting that the scores for near vision were less favorable in the PACG group than in the POAG group. The patients with PACG predominantly have hyperopic refraction anomaly; therefore, near vision is impaired on its own, but also due to the usage of myotics (if necessary).

Driving is very hard for patients with advanced glaucoma because of their poor distance vision and advanced visual-field defects [35]. Middle-aged patients with glaucoma can develop compensatory mechanisms while driving (head movement in the direction of the visual field defects). However, older patients with advanced glaucoma have much more difficulty with driving. According to our findings, PEG patients face more problems while driving than other groups. The results are not surprising, taking into consideration their poor distance vision, advanced visual-field defects, OSD symptoms, comorbidities, etc. Interestingly, a lot of participants confessed to not having a driving license due to their financial situation. The circumstances recorded for our specific context differ significantly from those recorded for developed countries. Social functioning is a very important aspect of the QoL. The ability to go out, meet friends and family, go shopping, visit the hospital, and pay bills is important for every individual [36].

The patients with PEG suffer from poor distance vision, comorbidities, ocular discomfort, etc., so they also reported the lowest levels of social functioning. The study subjects also highlighted that family gatherings and hospital visits were the most significant aspects of social functioning. Other options provided in this questionnaire, such as going out, going shopping, and going to a cinema or a theater, were not selected as crucial for our patients. These findings can be important for some future investigations, which may compare the habitual and cultural aspects between different nationalities. Daily activities, crucial elements of the QoL, are very hard for patients with PEG. Thus, patients with PEG face many obstacles in everyday activities and have to rely on other people to help them out [37].

Of all mental health disorders, anxiety and depression are predominant in glaucoma patients [38]. The available data demonstrate that anxiety is present in 13% of glaucoma patients in Japan, 14% in Turkey, 22.9% in China, and 17% in the USA [38–41]. This incidence rate is quite higher compared to the general population in these countries, where anxiety varies from 2.2 to 9.4% [36]. The incidence of depression is also statistically higher in glaucoma patients and reaches up to 22% in the USA, compared to 5.7% in the general population [41]. The high incidence rates of depression and anxiety in these patients can be attributed to their reduced visual acuity, their fear of the disease progression, as well as the difficulties they experience while driving, reading, walking, etc. Our results demonstrate that the incidence of depression and anxiety was significantly higher in our PEG patients. Many of them confessed that depression did not stem only from glaucoma. Low income and poor social opportunities for old persons were also reported as relevant factors. That is in line with the findings of other studies [42–44].

Visual field defect is proportional to QoL scores in glaucomatous patients. Higher MD values are associated with lower QoL scores [35]. Our findings show that PEG patients have the lowest QoL scores compared to the other two groups of patients. They also exhibited the lowest MD values, which can be blamed for the extremely low QoL of PEG patients. As our study suggests, patients with PEG have significantly higher incidence rates in many other domains, such as social functioning, dependence on others, driving, and peripheral vision ($p < 0.05$). However, no significant difference was recorded among the three groups in terms of matching clothing items based on their color ($p > 0.05$). The results may stem from the fact that our patients were mostly older. The elderly, especially from rural areas, do not consider matching colors of their garments an important factor in their everyday life. Similar results were obtained by Onakoya et al. [45]. Likewise, a study done by Marčeta and Todorovic [46] shows that the clinical characteristics of PEG are the least favorable, which complies with our results.

Conclusion

Our research has shown that glaucoma is much more than an eye disease because it affects many aspects of patients' lives. By comparing NEI VFQ-25 scores for three groups suffering from three different types of glaucoma, we found that the QoL of the patients with PEG was the lowest compared to the patients with POAG and PACG. The results are not surprising since the clinical characteristics of PEG are the least favorable. The findings further suggest that the QoL of glaucoma patients should receive more attention. The current state of affairs has to be improved. Medical staff can contribute by providing better insight into the nature, course, and medical prognoses of the disease, by putting more effort into increasing compliance rates, and by ameliorating the current treatments of ocular and systemic comorbidities. Psychiatric help should be also included. All these measures can greatly contribute to the more successful management of this complex disease. Studies like this can contribute to new meta-analysis studies and also in updating the literature on this topic.

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