

Impact of moderate and severe primary open-angle glaucoma on quality of life due to activity limitation

Shifali Nayyar, Suresh Kumar, Obaidur Rehman, Parul Ichhpujani, Ekta Singla

Purpose: To study the impact of moderate and severe primary open-angle glaucoma (POAG) on the quality of life (QoL) due to activity limitation using glaucoma-specific questionnaires. **Methods:** This cross-sectional study enrolled 122 participants, 50% ($n = 61$) being controls and 50% were diagnosed cases of moderate/severe POAG. Three orally administered glaucoma-specific QoL instruments were used: Glaucoma Activity Limitation (GAL-9), Glaucoma Quality of Life (GQL-15), and Viswanathan questionnaires. The questions related to activity limitation were identified and analyzed for each questionnaire separately. **Results:** The mean age of the participants was 61.04 ± 9.88 years and a majority were males (64.8%, $n = 79$). The mean scores in controls, moderate glaucoma, and severe POAG patients for GAL-9 questionnaire were 9.77 ± 1.36 ($P = 0.44$), 13.75 ± 4.76 ($P < 0.001$), and 23.45 ± 5.62 ($P < 0.001$), for GQL-15, these were 16.39 ± 2.18 ($P = 0.5$), 22.75 ± 7.89 ($P < 0.001$), and 39.34 ± 9.42 ($P < 0.001$), respectively, while for the Viswanathan questionnaire, they were 9.49 ± 0.94 ($P = 0.38$), 7.91 ± 1.59 ($P < 0.001$), and 4.41 ± 2.20 ($P < 0.001$), respectively. The GQL-15 and GAL-9 questionnaires concluded that activity limitation pertaining to dark adaptation-related tasks affected the QoL the most in moderate as well as severe POAG ($P < 0.001$). Using the Viswanathan questionnaire, it was observed that the peripheral vision-related activity limitation was most significant for the decrease in QoL in moderate POAG while near vision-related activity limitation affected the QoL the most in severe POAG ($P < 0.001$). **Conclusion:** All three questionnaires concluded that the activity limitation due to moderate and severe glaucoma has a negative impact on the QoL. The limitation of the tasks involving dark adaptation/glare and peripheral vision has the most significant impact on the QoL in moderate glaucoma. As the disease progresses to a severe category, the limitation of activities requiring central and near vision causes the most significant worsening in QoL.

Key words: Activity limitation, GAL-9, glaucoma, GQL-15, quality of life, Viswanathan questionnaire

The functional vision determines the ability of an individual to perform vision-dependent activities. It depends on different parameters such as visual acuity, contrast sensitivity, and field of vision.^[1] Visual disability in glaucoma degrades the quality of life (QoL) by limiting an individual's functional vision and negatively impacts the sense of wellness.^[2] Understanding the effects of glaucoma on a patient's perception of disability and consequent limitations is thus important. The routine clinical evaluation does not assess a patient's ability to perform routine activities of day-to-day life. The patient-reported outcomes (PROs) and performance-based measures (PBMs) can provide a better idea about how the visual disability worsens a patient's QoL. In resource-scarce countries with a huge patient burden, PROs are more practical for assessing the activity limitation and QoL. Glaucoma-specific instruments have been used to evaluate QoL in glaucoma^[3-5] but the literature remains deficient in the studies exclusively addressing the impact of activity limitation on the QoL in moderate and severe POAG patients. A previous study from our center had used glaucoma-specific questionnaires and concluded that

QoL is significantly worse in glaucoma patients.^[3] To the best of our knowledge, ours is the first study in India to utilize multiple glaucoma-specific instruments to assess the effect of glaucoma-related activity limitation on QoL.

Methods

Study design

The current study was a hospital-based, cross-sectional study conducted in the outpatients visiting the glaucoma services of a tertiary care center. The trial was registered with the Clinical Trials Registry of India (CTRI) vide registration number CTRI/2019/06/019753. Written informed consent was taken from all the participants before enrolment. The study adhered to the tenets of the Declaration of Helsinki and was approved by the Institutional Ethics Committee.

Sample size

The sample size was calculated assuming the mean QoL scores using GQL-15 in cases as 22.58 with a standard deviation of 11

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Cite this article as: Nayyar S, Kumar S, Rehman O, Ichhpujani P, Singla E. Impact of moderate and severe primary open-angle glaucoma on quality of life due to activity limitation. Indian J Ophthalmol 2022;70:552-7.

Access this article online

Website:
www.ijo.in

DOI:
10.4103/ijo.IJO_1687_21

Quick Response Code:



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Received: 20-Jun-2021

Revision: 22-Aug-2021

Accepted: 21-Sep-2021

Published: 27-Jan-2022

and in controls as 16.52 with a standard deviation of 9 as per the study by Kumar S *et al.*^[3] The other parameters considered for the sample size calculation were 90% power of the study and 5% alpha error. As per the above-mentioned calculation, the required sample size was 58 in each group. To account for the non-participation rate of about 5%, another three subjects were added to the sample. Hence, the final required sample size was 61 subjects in each group.

Sixty-one consecutive patients diagnosed with moderate and severe POAG and meeting the inclusion criteria were enrolled as cases. The inclusion criteria as a 'case' was as follows: moderate or severe POAG as per the Hodapp Anderson Parish (HAP) criteria,^[6] 40 years or older, of either gender, on medical therapy, or who had undergone trabeculectomy/cataract surgery at least 6 months prior to enrolment.

The exclusion criteria were the patients with mild glaucoma (mean deviation [MD] less than -6 dB), patients having mobility/cognitive/hearing impairment, psychiatric disease, immunosuppression, or ocular comorbidities.

The participants were enrolled as controls when they had no other ocular diagnosis other than refractive errors <5 D sphere of myopia/hypermetropia or <2 D cylinder of astigmatism, best-corrected visual acuity (BCVA) of at least 6/9, normal-appearing optic nerve heads (tilted disks and disks with congenital anomalies were excluded), normal visual fields, and no family history of glaucoma in a first-degree relative.

Methodology

An extensive history was taken and a detailed ocular examination was performed in all the participants. Uncorrected and BCVA (using Snellen's Visual Acuity Charts) was noted followed by a slit-lamp biomicroscopy (for the anterior segment and fundus examination including disk evaluation with a +90 D lens), intraocular pressure (IOP) measurement by a calibrated Goldmann Applanation Tonometer, CCT (central corneal thickness) measurement, and gonioscopy with 4-mirror Zeiss gonio lens (Modified Schaffer's grading^[7]). The automated visual field (VF) testing was performed with the Humphrey Visual Field analyzer (Carl Zeiss Meditec, Dublin) HVF 750 II using the SITA-Fast 24-2 protocol. The patients having VFs with false positives/false negatives more than 20% or fixation losses greater than 33% were excluded. The optic nerve head (ONH) damage assessment was done by DDLs (Disk Damage Likelihood Scaling system^[8]).

Procedure

All the patients were assessed by a single interviewer using orally administered QoL instruments comprising of three glaucoma-specific instruments: GAL-9, GQL-15, and Viswanathan questionnaires.

GQL-15 consists of 15 questions within four domains of apparent visual disability: central/near vision, peripheral vision, outdoor mobility, and glare/dark adaptation.^[9] GAL-9 is a truncated version of GQL-15, devised after the removal of six misfitting items. It has been noted that GAL-9 has superior psychometric properties than GQL-15.^[10] The Viswanathan questionnaire is a yes/no response instrument, having 10 questions related to various limitations due to vision loss such as finding dropped objects, activities given up because of visual limitations, and problems with glare.^[11]

The questions related to activity limitation were identified in all three questionnaires and a detailed analysis was done for each question. The scores for individual questions were analyzed and statistical significance was noted for each.

Statistical analysis

The data analysis was done using SPSS v23 (IBM Corp). The descriptive statistics were presented in the form of means/standard deviations and medians/IQRs for continuous variables while frequencies and percentages were used for categorical variables. Group comparisons for continuously distributed data were made using an independent sample *t*-test when comparing two groups, and one-way Analysis of variance (ANOVA) when comparing more than two groups. For non-normally distributed data, non-parametric tests such as Wilcoxon's test/Kruskal-Wallis test were used. The Chi-square test was done for group comparisons for categorical data. If the expected frequency in the contingency tables was <5 for >25% of the cells, Fisher's exact-test was utilized. The linear correlation between two continuous variables was studied using Pearson's correlation (for normally distributed data) and Spearman's correlation (for non-normally distributed data). The statistical significance was kept at $P < 0.05$.

Results

A total of 122 participants were enrolled, out of which 50% ($n = 61$) were controls while the other half constituted of diagnosed cases of moderate and severe POAG. Out of the 61 patients, 52.5% ($n = 32$) were moderate POAG patients while 47.5% ($n = 29$) were severe POAG patients. The mean age of the study population was 61.04 ± 9.88 years and the majority of the participants were males (64.8%, $n = 79$). The control group was comparable to both the case groups with respect to various sociodemographic parameters like age and gender, as no statistically significant difference was observed between them. No statistical difference was noted between the genders in any parameter across the three questionnaires in all the three study groups (controls, moderate POAG, and severe POAG). The details of the basic parameters among the three study groups are summarized in Table 1.

Mean QoL scores of the three questionnaires

The mean scores of GAL-9 questionnaire in the controls, moderate glaucoma, and severe POAG patients were noted to be 9.77 ± 1.36 ($P = 0.44$), 13.75 ± 4.76 ($P < 0.001$), and 23.45 ± 5.62 ($P < 0.001$), respectively. For GQL-15, these scores were 16.39 ± 2.18 ($P = 0.5$), 22.75 ± 7.89 ($P < 0.001$), and 39.34 ± 9.42 ($P < 0.001$), respectively, while the mean Viswanathan scores in the controls, moderate, and severe cases were 9.49 ± 0.94 ($P = 0.38$), 7.91 ± 1.59 ($P < 0.001$), and 4.41 ± 2.20 ($P < 0.001$), respectively. The mean scores of the three questionnaires are depicted in Fig. 1. The mean scores of all the three instruments correlated significantly with the vertical cup to disk ratio (VCDR) and perimetric MD in both the eyes ($P < 0.001$).

Activity limitation affecting QoL using GAL-9

For assessment of activity limitation affecting the QoL using GAL-9, all nine questions were considered. It was noted that all the questions pertaining to activity limitation degraded the QoL significantly in severe glaucoma patients when compared to controls ($P < 0.001$) while eight questions concluded significant QoL worsening due to activity limitation in moderate glaucoma ($P < 0.05$). Only 'Finding dropped

Table 1: Details of parameters across the study groups

Parameter	Total (n=122)	Controls (n=61)	Moderate POAG (n=32)	P (controls vs. moderate POAG)	Severe POAG (n=29)	P (controls vs. severe POAG)
Mean age (years)	61.04±9.88	58.92±9.20	64.78±8.97	0.066 ¹	61.38±11.20	0.065 ¹
Age distribution				0.089 ²		
40-49 years	23 (18.9%)	15 (24.6%)	2 (6.2%)		6 (20.7%)	0.114 ²
50-59 years	24 (19.7%)	15 (24.6%)	7 (21.9%)		2 (6.9%)	
60-69 years	50 (41.0%)	22 (36.1%)	13 (40.6%)		15 (51.7%)	
70-79 years	22 (18.0%)	9 (14.8%)	8 (25.0%)		5 (17.2%)	
80-89 years	3 (2.5%)	0 (0.0%)	2 (6.2%)		1 (3.4%)	
Gender						
Male	79 (64.8%)	35 (57.4%)	22 (68.8%)	0.088 ²	22 (75.9%)	0.197 ²
Female	43 (35.2%)	26 (42.6%)	10 (31.2%)		7 (24.1%)	
Employment Status						
Unemployed	44 (36.1%)	24 (39.3%)	12 (37.5%)	0.069 ²	8 (27.6%)	0.084 ²
Employed	15 (12.3%)	8 (13.1%)	2 (6.2%)		5 (17.2%)	
Self-Employed	29 (23.8%)	19 (31.1%)	6 (18.8%)		4 (13.8%)	
Retired	34 (27.9%)	10 (16.4%)	12 (37.5%)		12 (41.4%)	
Systemic Disease						
Diabetes	14 (11.5%)	6 (9.8%)	6 (18.8%)	0.500 ²	2 (6.9%)	0.088 ³
Hypertension	17 (13.9%)	11 (18.0%)	5 (15.6%)		1 (3.4%)	
Diabetes + Hypertension	10 (8.2%)	6 (9.8%)	0 (0.0%)		4 (13.8%)	
Hypertension + CAD	1 (0.8%)	0 (0.0%)	0 (0.0%)		1 (3.4%)	
None	80 (65.6%)	38 (62.3%)	21 (65.6%)		21 (72.4%)	
Drug Allergy (Present)	13 (10.7%)	0 (0.0%)	6 (18.8%)	<0.001 ³	7 (24.1%)	<0.001 ³
Previous Ocular Intervention						
None	70 (57.4%)	43 (70.5%)	17 (53.1%)	<0.001 ³	10 (34.5%)	<0.001 ³
Cataract surgery	36 (29.5%)	18 (29.5%)	11 (34.4%)		7 (24.1%)	
Trabeculectomy	7 (5.7%)	0 (0.0%)	2 (6.2%)		5 (17.2%)	
Cataract + Trabeculectomy	9 (7.4%)	0 (0.0%)	2 (6.2%)		7 (24.1%)	

***Significant at $P < 0.05$, 1: Kruskal-Wallis Test, 2: Chi-square test, 3: Fisher's exact-test

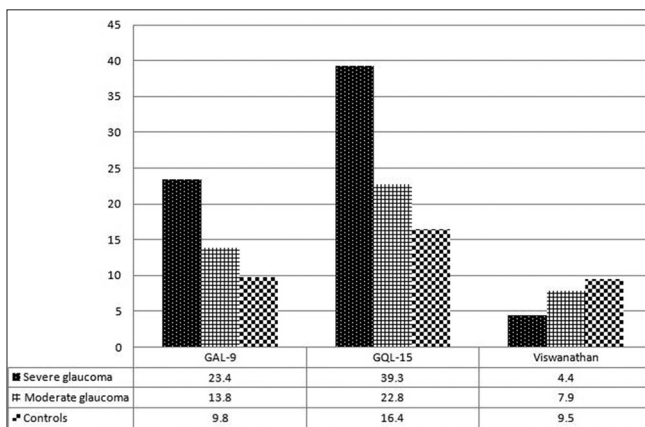


Figure 1: Mean scores of all three questionnaires across the study groups

objects' was non-significant for activity limitation in moderate glaucoma patients ($P = 0.111$). As the severity of glaucoma increased from moderate to severe category, a significant worsening of QoL due to activity limitation was noted by all the nine questions ($P < 0.001$). Table 2 elucidates individual QoL scores of each question due to activity limitation in the GAL-9 questionnaire.

GQL-15

In GQL-15, 11 questions from the four domains were related to daily activity limitation and were analyzed. All questions

pertaining to activity limitation in this questionnaire were significant for QoL worsening in severe glaucoma patients when compared to controls ($P < 0.001$), while only eight were significant for QoL worsening due to activity limitation in moderate glaucoma patients ($P < 0.05$). The questions 'Reading newspaper' ($P = 0.494$), 'Seeing at night' ($P = 0.064$), and 'Finding dropped objects' ($P = 0.081$) were noted to be non-significant in moderate glaucoma patients. With the increase in severity, all questions revealed significant affection of QoL due to activity limitation ($P < 0.001$). A detailed analysis of the questions in GQL-15 is shown in Table 3.

Viswanathan questionnaire

This questionnaire had 7 questions related to activity limitation, out of a total of 10. All the questions were significant ($P < 0.001$) for activity limitation affecting QoL in severe glaucoma patients when compared to controls but only two questions, 'Do you ever notice that parts of your field of vision are missing' ($P < 0.001$) and 'Do you trip on things or have difficulty with stairs?' ($P = 0.038$) were significant for QoL worsening due to activity limitation in moderate glaucoma. When the role of activity limitation in QoL worsening was studied with increasing severity of glaucoma, all questions except for one were significant for the same ($P < 0.001$). Only 'Do you ever notice that parts of your field of vision are missing?' ($P = 0.952$) was found to be non-significant. Table 4 elucidates the detailed analysis of activity limitation in QoL worsening using the Viswanathan questionnaire.

Table 2: Assessment of activity limitation in GAL-9

Parameter	Controls (n=61)	Moderate POAG (n=32)	P	Severe POAG (n=29)	P
Q1. Walking after dark	1.13±0.34	1.69±0.64	<0.001	2.72±0.84	<0.001
Q2. Seeing at night	1.20±0.40	1.62±0.71	0.035	2.86±0.83	<0.001
Q3. Walking on uneven ground	1.02±0.13	1.62±0.66	<0.001	2.72±0.80	<0.001
Q4. Adjusting to dim lights	1.08±0.28	1.50±0.57	0.004	2.48±0.83	<0.001
Q5. Going from a light to a dark room or vice-versa	1.21±0.41	1.56±0.56	0.032	2.59±0.91	<0.001
Q6. Seeing objects coming from the side	1.00±0.00	1.47±0.67	0.003	2.62±0.82	<0.001
Q7. Walking on steps/stairs	1.02±0.13	1.41±0.56	0.006	2.45±0.78	<0.001
Q8. Judging distance of foot to step/curb	1.00±0.00	1.44±0.67	0.004	2.31±0.66	<0.001
Q9. Finding dropped objects	1.11±0.32	1.44±0.67	0.111	2.69±0.85	<0.001

Table 3: Assessment of activity limitation in GQL-15

Parameter	Controls (n=61)	Moderate POAG (n=32)	P	Severe POAG (n=29)	P
Q1. Reading newspapers	1.33±0.47	1.53±0.62	0.494	2.72±0.88	<0.001
Q2. Walking after dark	1.13±0.34	1.72±0.63	<0.001	2.76±0.79	<0.001
Q3. Seeing at night	1.23±0.42	1.62±0.71	0.064	2.90±0.77	<0.001
Q4. Walking on uneven ground	1.03±0.18	1.62±0.66	<0.001	2.72±0.80	<0.001
Q5. Adjusting to bright lights	1.15±0.40	1.59±0.71	0.013	2.62±0.86	<0.001
Q7. Going from a light to a dark room or vice-versa	1.21±0.41	1.56±0.56	0.035	2.62±0.90	<0.001
Q9. Seeing objects coming from the side	1.02±0.13	1.47±0.67	0.006	2.72±0.84	<0.001
Q10. Crossing the road	1.03±0.18	1.50±0.72	0.008	2.72±0.84	<0.001
Q11. Walking on steps/stairs	1.02±0.13	1.41±0.56	0.006	2.48±0.78	<0.001
Q13. Judging distance of foot to step/curb	1.00±0.00	1.41±0.61	0.004	2.28±0.70	<0.001
Q14. Finding dropped objects	1.10±0.30	1.44±0.67	0.081	2.69±0.85	<0.001

Table 4: Assessment of activity limitation in Viswanathan Questionnaire

Parameter	Controls (n=61)	Moderate POAG (n=32)	P for moderate POAG vs. controls	Severe POAG (n=29)	P For severe POAG vs. controls	P for moderate POAG vs. severe POAG
Q1. Do you ever notice that parts of your field of vision are missing? (Yes)	0 (0.0%)	19 (59.4%)	<0.001	17 (58.6%)	<0.001	0.952
Q3. Do you ever have trouble following a line of print or finding the next line when reading? (Yes)	9 (14.8%)	7 (21.9%)	0.400	23 (79.3%)	<0.001	<0.001
Q6. Do you trip on things or have difficulty with stairs? (Yes)	0 (0.0%)	3 (9.4%)	0.038	19 (65.5%)	<0.001	<0.001
Q7. Have you had to give up activities because of your sight? (Yes)	0 (0.0%)	0 (0.0%)	1.000	7 (24.1%)	<0.001	0.004
Q8. Do you have difficulty finding things that you have dropped? (Yes)	2 (3.3%)	1 (3.1%)	1.000	17 (58.6%)	<0.001	<0.001
Q9. Are you troubled by glare or dazzled on sunny days or in bright lighting? (Yes)	13 (21.3%)	4 (12.5%)	0.401	17 (58.6%)	<0.001	<0.001
Q10. Do you have any particular difficulty seeing after moving from a light to a dark room? (Yes)	5 (8.2%)	5 (15.6%)	0.304	20 (69.0%)	<0.001	<0.001

Discussion

In our study, a domain-wise analysis showed that activity limitation significantly affected the QoL in all the domains in severe glaucoma ($P < 0.001$) in both GQL-15 and GAL-9. In moderate glaucoma patients, both questionnaires indicated a significant effect on QoL due to activity limitation in all the

domains except for the *central and near vision*. This suggests that the central and near vision are relatively spared early in the disease and activities such as reading, finding dropped objects get affected only in severe disease but dark adaptation/glare, outdoor mobility, peripheral vision are affected even in moderate disease. While assessing the impact of activity limitation on QoL using the Viswanathan score, we observed

that the maximum patients in moderate glaucoma responded to the question 'Do you ever notice that parts of your field of vision are missing?' (59.4%, $n = 19$) while severe glaucoma patients had maximum responses to the question 'Do you ever have trouble following a line of print or finding the next line when reading?' (79.3%, $n = 23$). The findings from the Viswanathan questionnaire indicate that severe glaucoma patients have the most significant worsening of QoL because of the limitation of tasks involving central/near vision while in moderate glaucoma, limitation due to peripheral vision loss is most troublesome.

The central and near vision is indispensable to an individual as simple tasks such as reading, recognizing faces, or finding dropped objects are dependent on them. Aspinall^[12] and coworkers in their study concluded that the glaucoma patients gave the highest importance to activities involving central/near vision and outdoor mobility but as the severity of the visual loss increased, the concern for central vision was more. Our study has similarly shown that the central/near vision limitation was not statistically significant in moderate glaucoma but highly significant in severe glaucoma. Activities involving central and near vision such as reading/recognizing faces/finding dropped objects, thus, are a priority to patients as the disease worsens. Dhawan^[5] and coworkers had noted in their study that the difference in the GQL-15 scores was maximum between mild and moderate glaucoma for performing all tasks except for tasks involving the central/near vision, which showed the maximum difference between the moderate and severe category. These findings further support our conclusion that limitation of activities needing central/near vision is more significant for reducing QoL in severe cases of glaucoma. A study by Daruka^[4] correlated activity limitation with central field index (on 10-2 VF analysis) and concluded that 'finding dropped objects' had the strongest correlation with the central field index of the better eye. Reading is a vital activity required for a majority of everyday tasks, be it the use of a cell phone or a patient reading his prescription. Kwon^[13] and his team reported a significantly reduced speed of reading in glaucoma cases, when compared to controls, and a shrunken visual span was reported to be the reason behind it. These findings increased as the severity of the disease worsened. The reduction in reading speed has also been explained as a result of contrast loss by Ramulu and coworkers.^[14] As the ability to distinguish the contrast worsens with increasing severity, the reading speed further goes down. In our study, we noted a strong correlation of GQL-15 central/near vision domain with the question 'Do you ever have trouble following a line of print or finding the next line when reading?' of the Viswanathan questionnaire (Pearson's correlation coefficient = 0.651, significant at 0.01, two-tailed).

Dark adaptation is required whenever the eye has to adjust to a dim environment from a brighter one, such as when doing tasks in a dimly lit room or walking/driving at night. Glare is visual distress caused by a bright light source and is relevant in conditions such as bright, sunny outdoor conditions or headlight glare from an opposite vehicle while driving. In our study, the POAG cases in both moderate and severe categories gave a maximum score to activity limitation pertaining to the dark adaptation/glare domain. Our findings suggest that the limitation of activities involving dark adaptation and glare most significantly affect the QoL in moderate as well severe

diseases. In the Viswanathan questionnaire, the questions 'Are you troubled by glare or dazzled on sunny days or in bright lighting?' and 'Do you have particular difficulty seeing after moving from a light to a dark room?' showed a strong correlation with dark adaptation/glare domain of GQL-15 (Pearson's correlation coefficient = 0.591, significant at 0.01, two-tailed). The previous studies have observed that dark adaptation and glare were the most troublesome issues for patients in even earlier stages of the disease.^[15,16] Studies have shown reduced light sensitivity, more so in the rod component of dark adaptation in the glaucomatous disk damage, which causes a problem in dark adaptation.^[17] A study by Hamedani^[18] and his team found decreased objective and subjective acuity in glaucoma patients when glare was present, which correlated with the severity of the disease. It was a significant limiting factor for the patients when the cause for glare was bright outdoor conditions or headlights of a car. While driving at night is certainly troublesome for glaucoma patients due to dark adaptation problems, it gets compounded by the glare from the opposite approaching vehicles.

Peripheral vision is needed in everyday life while driving/crossing roads to notice the approaching vehicles or while walking on uneven ground or when walking on the stairs by judging the distance of foot to step. We observed that the activity limitation in the peripheral vision domain significantly impacted the QoL in moderate as well as severe cases. The patients gave lesser scores to this domain as compared to dark adaptation/glare and central/near vision. However, a study by Dhawan^[5] and his team that evaluated vision-related QoL in glaucoma using GQL-15 had concluded that patients in all categories of the disease faced the most difficulty in the tasks that involved peripheral vision. They also noted that the mid-peripheral visual field is affected first in the disease and central/near vision much later.

While considering outdoor mobility, the overlap of other domains with it should be kept in mind such as the use of peripheral vision along with an adjustment to ambient conditions (glare in bright conditions/dark adaptation at night). We observed that patients in both categories of POAG had significant limitations of outdoor mobility but gave lesser importance to this domain than central/near vision and dark adaptation/glare domains. A study by Turano^[19] and coworkers compared mobility performance between the glaucoma patients and normal subjects by calculating the time required to complete a travel path. They concluded that glaucoma patients had a modest reduction in mobility, which increased as the severity of the disease increased. The mobility assessment in glaucoma was also done by the Salisbury Eye Study (SEE)^[20] and it was observed that patients with bilateral glaucoma had significant difficulty in crossing an obstacle course than normal individuals, despite adjustment for mobility aids and visual acuity.

After extensive statistical analysis of the three questionnaires, across all three study groups, we could identify the tasks, limitations of which had a significant impact on QoL in moderate as well severe cases of glaucoma. To the best of our knowledge, this is the first study to use glaucoma-specific questionnaires in order to assess the impact of activity limitation on QoL in moderate and severe glaucoma.

The strengths of our study include robust sample size and cases with variable degrees of disease. The use of three different questionnaires makes this study comprehensive in nature and

administration of all questionnaires by a single investigator rules out interobserver bias.

There are a few limitations to this study also. The questionnaires are subjective and the response depends on the patient's understanding, own perception of disease, and the response may even vary according to the educational background. PBMs can address this limitation by actual demonstration of the tasks but are time- and resource-consuming, which may be a limiting factor in developing countries.

While a lot may go unnoticed in the mild category of glaucoma, our study tries to understand the implications on QoL due to the limitation of daily routine activities when the disease has progressed to moderate and severe stages.

Conclusion

All three questionnaires determined a negative impact on QoL due to glaucoma-related activity limitation. The limitation of tasks involving dark adaptation/glare and peripheral vision have the most significant impact on QoL in moderate glaucoma while the limitation of activities that require central and near vision most significantly worsen QoL in severe glaucoma.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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