

ORIGINAL ARTICLE

CORRELATION OF STRUCTURE AND FUNCTIONAL DEFECT WITH QUALITY OF LIFE IN PATIENT WITH GLAUCOMA**Meta Rahma An Nazzila¹, Krisna Dwi Purnomo Jati¹, Retno Ekantini¹, Tatang Talka Gani¹**

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ABSTRACT

Introduction: Glaucoma damage generally produces a characteristic change in the morphology of the optic nerve, runs progressively and permanently that cause visual changes, decreased vision, and blindness. Blindness will affect one's dependence to get help in their daily activities. This paper investigate the correlation between VFI, BCVA, MD and RNFL thickness with the quality of life of people with glaucoma using Glaucoma Quality of Life-15 (GQL-15).

Methods: A cross-sectional study conducted at the Sardjito Eye Center in April 2021. Purposive sampling used to recruit glaucoma patients who had BCVA, Visual Field examination (Humphrey Field Analyzer (HFA) 3 Carl Zeiss Meditec Inc.), and OCT ONH (Cirrus HD-OCT 5000, Carl Zeiss). Glaucoma Quality of Life-15 (GQL-15) questionnaire were used to interview the patients.

Results: Eight (32%) normotension glaucoma and 17 (68%) open angle glaucoma patients were included. Fifteen (60%) patients aged 17-40 y.o, 7 (28%) aged 41-60 y.o and 3 (12%) aged > 60 y.o were included. Majority of the samples 6 of them were unemployed (24%), 5 entrepreneurs 5 (20%) and 5 students (20%). GQL-15 score was significantly correlated with respondent's BCVA $r = -0.39$ ($p = 0.05$). However, there was no correlation between GQL-15 with RNFL $r = 0.01$ ($p = 0.94$), VFI $r = -0.21$ ($p = 0.29$) and MD with $r = 0.09$ ($p = 0.66$) respectively. It showed that VFI and GQL-15 has negative correlation with a correlation coefficient of -0.21 ($p = 0.29$). Subscale score related to central and near was significantly correlated with VFI ($p = 0,05$) and MD ($p = 0,03$).

Conclusion: There was a significant correlation between GQL-15 subscale score of central and near vision with VFI and MD. Subjects with lower VFI and MD tend to have worse problem with central and near vision. Total GQL-15 score has a weak negative correlation with BCVA and MD. There was no correlation between GQL-15 with VFI and RNFL.

Keywords: Glaucoma Quality of Life-15, OCT, Visual Field Index

INTRODUCTION

Glaucoma damage generally produces a characteristic change in the morphology of the optic nerve, runs progressively and permanently that cause visual changes, decreased vision, and blindness. Blindness will affect one's dependence to get help in their daily activities. Periodic evaluation of the optic nerve and visual field testing is very important in the management of glaucoma. Documentation of optic nerve imaging or retinal nerve fiber layer (RNFL) helps detect changes over time. Visual field (VFI or Visual Field Index) loss should be correlated with optic nerve imaging. Optic nerve damage can lead to functional dysfunction and decreased quality of life related to vision.¹

Most studies on the quality of life of glaucoma patients used the Mean Deviation (MD) index. MD can reliably evaluate visual field damage, however it is not sensitive in identifying focal depression caused by cataracts. From a previous study by Heijl detecting central visual field defects with VFI was more reliable without being affected by cataracts.^{2,8}

WHO defines quality of life (QOL) as a patient's perspective towards their position in life, including in the context of the culture and assessment system in which they live and in relation to their goals, expectations, and standards of living.¹⁰

The impact of glaucoma on a patient's QOL can be significant. Visual impairment can affect a person's ability to perform daily activities, work, and social interactions. The psychological impact of vision loss, including anxiety and depression, is also a concern. Various questionnaires and scales have been developed to assess QOL in glaucoma patients, such as the Glaucoma Quality of Life-15 (GQL-15) and the National Eye Institute Visual Function Questionnaire (NEI VFQ-25). The GQL-15 is a brief questionnaire designed to assess the impact of glaucoma on patients' quality of life. It consists of 15 questions that cover various aspects of daily life, including vision-related activities, psychological well-being, and social functioning.⁹

The correlation between structural and functional defects in glaucoma with the quality of life, as assessed by the GQL-15, highlights the complex relationship between clinical measures of disease severity and the subjective experience of living with glaucoma. Objective measures of visual function are important for diagnosis and management. Some studies showed a clear relationship between the severity of visual field loss and QOL, however, the impact of structural changes on QOL is less well understood.⁹

Glaucoma is often overlooked and only focuses on the assessment of intraocular pressure, visual field changes, and visualization of the optic disc. Decisions for initiating therapy or changing therapy in glaucoma patients are never easy and must take into account each patient's expectations. The goal of glaucoma treatment is to maintain the patient's quality of life and visual acuity simultaneously.⁴

Thus, knowledge of the quality of life in glaucoma patients would provide insights into the patient's perspective and can help guide treatment decisions and patient care resulting in better disease management. The research aims to investigate the correlation between VFI (Visual Field Index), BCVA (Best Corrected Visual Acuity), MD (Mean Deviation), and RNFL (Retinal Nerve Fiber Layer) thickness with the quality of life of people with glaucoma using Glaucoma Quality of Life-15 (GQL-15).

METHODS

This study is an analytic cross-sectional study conducted at the Glaucoma Subdivision of Sardjito Eye Center in Sardjito General Hospital Yogyakarta during April 2021. The inclusion criteria were subjects aged 17 years old and above, diagnosed with Open Angle Glaucoma. The exclusion criteria were patients with best corrected visual acuity less than 1/60, had other eye diseases with vision impairment secondary to other causes such as inflammation and ocular surface abnormalities such as keratitis, uveitis, and keratopathy and also retinal disorders.

After obtaining ethical approval from the institutional ethics board, a written informed consent was obtained from the eligible subjects who met the inclusion criteria prior to recruitment, then given explanation of the objectives, procedure and benefits of the study. Collection of data includes the patient's name, gender, and diagnosis. Patients' social status such as education level and occupation were collected.

Ophthalmological examination was done including Best Corrected Visual Acuity using Snellen Chart then patient underwent Visual Field examination to evaluate functional defect using the 24-2 pattern Swedish interactive threshold algorithm on the Humphrey Field Analyzer (Carl Zeiss Meditec, Dublin, CA) and examined for optic nerve head structural defect using OCT ONH (Cirrus HD-OCT 5000, Carl Zeiss).

Glaucoma Quality of Life-15 (GQL-15) questionnaire were used to interview the patients. Patients were asked 15 questions to assess the degree of functional disability. The questionnaire composed by four domains of visual disability: 1) central and near vision; 2) peripheral vision; 3) dark adaptation and glare; and 4) outdoor mobility. All questions (15 items) were significant predictors of visual field loss in factor analysis. Each question has score range from 1 (means no difficulty) to 5 (severe difficulty), and 0 represents "unable to do the activity due to non-visual reasons". Higher subscale scores represents more difficulty with vision-related activities and poor G-QOL (Glaucoma-Quality of Life).

The questions were translated and culturally adapted into Indonesian, by one glaucoma expert and one ophthalmology resident from Universitas Gadjah Mada of whom were aware of the purposes of the study. Each question was also modified from its original form to make the interviewer easier to ask the questionnaire and the subject understand better. The interviews were done by one interviewer to reduce potential bias.

RESULTS

Baseline Characteristics

A total of 25 subjects were included in this study. According to Table 1, there were eight subjects (32%) diagnosed with normal-tension glaucoma and 17 (68%) of them diagnosed with open angle glaucoma. Fifteen (60%) patients aged 17-40 years old, 7 (28%) of them aged 41-60 years old and 3 (12%) subjects aged more than 60 years old were included. Nine (36%) of the subjects were male and 16 of them (64%) were female.

Six of subjects were unemployed (24%), 5 subjects had occupation as entrepreneurs (20%), 5 as students (20%), where lower percentage were farmers, college student, lecturer, civil servant, doctor and labourer with total 4 (16%), 1 (4%), 1 (4%), 1 (4%), 1 (4%) and 1 (4%) respectively. Subjects' latest education were high school with total number 11 (44%), 7 (28%) subjects had bachelor degree and above, 4 (16%) studied until elementary school and 3 (12%) of them had middle school as their latest education.

Table 1. Baseline characteristics

| Characteristics | N (%) |
|---------------------|----------|
| Age in years | |
| 17-40 | 15 (60%) |
| 41-60 | 7 (28%) |
| > 60 | 3 (12%) |
| Sex | |
| Female | 9 (36%) |
| Male | 16 (64%) |
| Occupation | |
| Entrepreneur | 5 (20%) |
| Farmer | 4 (16%) |
| Student | 5 (20%) |
| College student | 1 (4%) |
| Lecturer | 1 (4%) |
| Civil servant | 1 (4%) |
| Doctor | 1 (4%) |
| Labourer | 1 (4%) |
| Unemployed | 6 (24%) |
| Education | |
| Elementary School | 4 (16%) |
| Middle School | 3 (12%) |
| High School | 11 (44%) |
| Bachelor and above | 7 (28%) |
| Diagnosis | |
| NTG | 8 (32%) |
| POAG | 17 (68%) |

NTG: Normal-tension Glaucoma; POAG (primary Open Angle Glaucoma)

Statistical Analysis

Based on the statistical analysis (Table 2) using Spearman correlation test, it indicates that GQL-15 score was significantly correlated with respondent's BCVA $r = -0.39$ ($p = 0.05$). However, for other variables, there was no correlation between GQL-15 with RNFL $r = 0.01$ ($p = 0.94$), VFI $r = -0.21$ ($p = 0.29$) and MD with $r = 0.09$ ($p = 0.66$) respectively. It showed that VFI and GQL-15 has negative correlation with a correlation coefficient of -0.21 ($p = 0.29$).

Table 2. Correlation of GQL-15 Questionnaire and BCVA, RNFL, VFI and MD

| Variables | QGL-15 | |
|-----------|-----------------------------|---------|
| | Correlation coefficient (r) | p-value |
| BCVA | -0.39 | 0.05* |
| VFI | -0.21 | 0.29 |
| MD | 0.09 | 0.66 |
| RNFL | 0.01 | 0.94 |

*BCVA: Best Corrected Visual Acuity; VFI: Visual Field Index; MD: Mean Deviation; RNFL: Retinal Nerve Fiber Layer. Note: the significance value is $p \leq 0.05$. The sign * indicates statistical significance, r: correlation coefficient using the Spearman correlation test.*

As shown in Table 3, the question "Tripping over subjects" has the highest mean (SD) 2,08 (1,18) among all questions. However, the Spearman's analysis indicates that there was no significant correlation between each item in the GQL-15 with functional defect (VFI and MD). Subscale score (Table 4) showed that activities demanding central and near vision such as reading newspapers and recognizing faces was significantly correlated with both VFI (p-value 0,05) and MD (p-value 0,03).

Table 3. Correlation between GQL-15 question and functional defect (VFI, MD)

| GQL-15 items | Mean (SD) | | VFI | | MD | | |
|---|-----------|-----|---------------|---------|------|---------|------|
| | Min | Max | (r) | p-value | (r) | p-value | |
| 1. Reading newspapers | 1 | 3 | 1,44 (0,71) | -0,66 | 8,48 | 0,69 | 1,42 |
| 2. Walking after dark | 1 | 4 | 1,64 (0,99) | 0,10 | 0,64 | -0,13 | 0,53 |
| 3. Seeing at night | 1 | 5 | 1,72 (1,06) | 0,17 | 0,40 | -0,1 | 0,63 |
| 4. Walking on uneven ground | 1 | 4 | 1,6 (0,91) | 0,02 | 0,91 | -0,04 | 0,83 |
| 5. Adjusting to bright lights | 1 | 4 | 1,36 (0,75) | 0,21 | 0,32 | -0,23 | 0,24 |
| 6. Adjusting to dim lights | 1 | 2 | 1,16 (0,37) | 0,14 | 0,51 | -0,13 | 0,52 |
| 7. Going from light to dark or vice versa | 1 | 3 | 1,6 (0,86) | 0,31 | 0,13 | -0,34 | 0,06 |
| 8. Tripping over objects | 1 | 5 | 2,08 (1,18)** | -0,01 | 0,95 | 0,03 | 0,87 |

| | | | | | | | |
|---|---|---|-------------|-------|------|-------|------|
| 9. Seeing objects coming from the side | 1 | 3 | 1,52 (0,71) | -0,01 | 0,97 | 0,02 | 0,91 |
| 10. Crossing the road | 1 | 4 | 1,32 (0,9) | 0,11 | 0,58 | -0,11 | 0,59 |
| 11. Walking on steps/stairs | 1 | 5 | 1,4 (1,04) | 0,11 | 0,60 | -0,05 | 0,79 |
| 12. Bumping into objects | 1 | 4 | 1,4 (0,76) | 0,01 | 0,96 | 0,06 | 0,75 |
| 13. Judging distance of foot to step/curb | 1 | 4 | 1,64 (0,95) | -0,01 | 0,94 | -0,02 | 0,90 |
| 14. Finding dropped objects | 0 | 4 | 1,32 (0,62) | 0,06 | 0,76 | -0,06 | 0,77 |
| 15. Recognizing faces | 1 | 4 | 1,64 (0,90) | 0,00 | 0,99 | 0,01 | 0,94 |

*GQL-15: Glaucoma Quality of Life-15; VFI: Visual Field Index; MD: Mean Deviation. Note: The sign ** indicates highest Mean and Standard Deviation (SD)*

Table 4. Correlation between GQL-15 subscales and functional defect (VFI and MD)

| GQL-15 Subscales | VFI | | MD | |
|--|-------|-----------------|-------|-----------------|
| | (r) | <i>p</i> -value | (r) | <i>p</i> -value |
| Central and near vision (1,15) | -0,38 | 0,05* | 0,41 | 0,03* |
| Peripheral Vision (4,8,9,11,12,13) | 0,03 | 0,87 | -0,00 | 0,98 |
| Glare and dark adaptation (2,3,5,6,7,14) | 0,34 | 0,09 | -0,35 | 0,08 |
| Outdoor mobility (10) | 0,11 | 0,58 | -0,11 | 0,59 |

*GQL-15: Glaucoma Quality of Life-15; VFI: Visual Field Index; MD: Mean Deviation. Note: the significance value is $p < 0.05$. The sign * indicates statistical significance, r: correlation coefficient using the Spearman correlation test*

DISCUSSION

This study confirmed that worse BCVA has correlation with higher GQL-15 score, meaning that subjects with worse BCVA has decrease in quality of life. Subjects who had worse BCVA, had higher score of GQL-15 score. This is consistent with the research conducted by Lee JW, et al in 2014 which stated that the worse the visual acuity, the higher the average GQL-15 score.⁵

Using the NEI-VFQ-25 (National Eye Institute Visual Function Questionnaire-25) questionnaire, Sawada et al studied the correlation of VFI and MD with the quality of life in glaucoma patients in Japan resulting in VFI has better correlation than MD, meaning that there was correlation between quality of life with VFI and MD. This was not in line with our study that there was no correlation between VFI, however there was a weak negative correlation between quality of life and MD. Worsening MD score as seen from the more negative values of MD, showing higher score of GQL-15.⁸

Other result obtained from this study, there was no correlation between GQL-15 score and RNFL thickness. This finding was not in line with the research conducted by Lee, et al in 2014, which stated that thinner RNFL was associated with the worse the GQL-15 score.⁵

There was a significant correlation between subscale score of central and near vision with VFI and MD. Thus, it can be concluded that the lower the VFI, the more the subject had problem with central and near vision. Higher MD value showed the less the subject had problem with central and near vision subscale. This result is aligned with research in 2011 by Hirneiss that most questions of the GQL-15 correlated significantly with the MD of the worse eye. Other study conducted by Naveen showed that in mild glaucoma patients, had most problem with activities relating to dark and glare adaptation followed by central and near vision.^{3,6}

No significant correlation between question number 8 "*Tripping over subjects*" which has the highest mean with the VFI and MD, might indicates there may be occult visual loss outside the 24-2 static perimetry. This is not aligned with study conducted by Nelson in 2003 that activities demanding peripheral vision such as tripping over and bumping into objects was significantly correlated with binocular vision field loss.⁷

Limitations of this study which potentially contributed to lack of significance correlation include small sample size, lack of severity variation of the subjects, and subjectivity of each individual answering the questionnaire, thus the results of the do not really represent the actual disturbance experienced by the patient. In future research, it is hoped that this study can be carried out in wide severity variation, especially in advanced glaucoma patients.

CONCLUSION

This study shows a significant correlation between subscale score of central and near vision with VFI and MD. Thus, it proposed that lower VFI, resulting in worse problem with central and near vision. Quality of life, structural and functional eye conditions evaluation can be used to provide treatment that is customized to the patient's condition.

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