Original Article

Correlation of central field index (10–2 visual field analysis) and activity limitation with increasing severity of glaucoma using glaucoma activity limitation-9 questionnaire

Ravi Daruka, Neetha I R Kuzhuppilly[1], Shibi Dev, Shilpa N Patil[2], Sandhya Rajendraprasad

Purpose: The purpose of the study was to analyze the correlation between central field index (CFI) and activity limitation in glaucoma using glaucoma activity limitation-9 (GAL-9) questionnaire. **Methods:** This hospital-based, cross-sectional, noninterventional study, included 50 patients diagnosed with glaucoma, with field defect encroaching onto central 10° in Humphrey field analysis 30–2 program, in at least one eye. These patients underwent central 10–2 field analysis and CFI was calculated with the help of a calculator created by us. Patients with severe cognitive impairment were excluded and the rest completed the GAL-9 questionnaire. The data was analyzed to determine the correlation between the CFI and the GAL-9 scores. **Results:** There was a moderate correlation between CFI of better eye (r = −0.431, confidence interval "CI" −0.619 to −0.173, P < 0.002) and worse eye (r = −0.342, CI: −0.575 to − 0.058, P < 0.015) with GAL-9, the better eye showing a stronger correlation. Mean deviations (MD) of both better (r = −0.345, CI: −0.556 to −0.069, P < 0.014) and worse eye (r = −0.346, CI: −0.578 to −0.063 P < 0.014) showed similar moderate correlation. Vision of better eye (r = −0.398, CI: −0.577 to −0.210, P < 0.004) showed a stronger correlation with GAL-9 score than worse eye (r = −0.188, CI: −0.475 to 0.100, P < 0.192). Subscales of GAL-9 questionnaire also correlated with better eye status. "Finding dropped objects" had the strongest correlation to CFI of better eye (r = −0.676) and "adjusting to dim lights" had the weakest correlation (r = −0.052). **Conclusion:** The better eye status in glaucoma patients correlated better than worse eye with regard to activity limitation, signifying that the better eye has a greater influence on the quality of life and how patients perceive their disability. Furthermore, CFI showed a better correlation with GAL-9 score than MD.

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With increasing life expectancy across the globe, chronic eye diseases are becoming increasingly important. Glaucoma is the third largest cause of visual impairment and second largest cause of blindness worldwide.[1]

Glaucoma is often asymptomatic. Nevertheless, the diagnosis, which requires lifelong follow-up and frequent ocular antihypertensive medication or surgery, can have a huge impact on a patient's life.[2] Hence, a comprehensive assessment of the impact of the disease on patients, from their perspective is important. This is done using questionnaires known as patient-reported outcomes (PROs). Gutierrez *et al*. found a steady linear decline between visual field loss and health-related quality of life (QOL) in glaucoma patients using the national eye institute visual function questionnaire (NEI-VFQ).[3] Studies have found glaucoma to be associated with slower walking,[4] falling,[5] and avoidance of difficult driving situations.[6] Work based on hypothetical scenarios presented to glaucoma patients to assess which activities are most important showed greatest importance to tasks involving central and near vision (i.e., reading), with high scores also given to mobility outside the home (i.e., driving and walking outside).[7,8]

In advanced stages, glaucoma affects the central visual field. The 24–2 and 30–2 programs have limited ability to detect visual field abnormalities in the macular region,[9] which despite corresponding to only 10° of the human visual field, is responsible for up to 60% of the area of the visual cortex and hence has significant importance for vision-related QOL.[10,11] For this reason, a 10–2 program of Humphrey field analyzer (HFA) is often used, which is more sensitive and specific for central field abnormalities and progression than 24–2 test.[12]

de Moraes *et al*. proposed a new index, central field index (CFI) for 10–2 program,[13] on lines similar to visual field index (VFI),[14] to summarize information from 10-2 tests as a single global parameter. They established it as a robust global index to monitor glaucomatous change when the central field

Department of Glaucoma, Nethradhama Superspeciality Eye Hospital, Bengaluru, [1]Department of Ophthalmology, Kasturba Medical College, Manipal, Manipal Academy of Higher Education, Karnataka, [2]Aastha Superspeciality Eye Hospital, Bengaluru, India

Correspondence to: Dr. Neetha I R Kuzhuppilly, Sonia Clinic, 24, Ananth Nagar, Manipal, Udupi - 576 104, Karnataka, India. E-mail: cinnineetha@gmail.com

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is affected or threatened. CFI is represented as a percentage scale ranging from 0% to 100%. Its calculation is based on the 10–2 pattern deviation probability plots, which allows better discrimination between glaucomatous visual field defects and those that result from media opacity, particularly cataract. They also proved that CFI provides a meaningful and more accurate representation of the extent and rate of visual field progression in the central field than any other currently used parameter of visual field severity assessment and progression including the VFI.

The glaucoma activity limitation-9 (GAL-9) questionnaire, a glaucoma specific questionnaire, was devised by reengineering the glaucoma QOL-15 questionnaire and was shown to have superior psychometric properties, including unidimensionality and good measurement precision, with the added advantage of low respondent burden.[15] The GAL-9 is the only PRO designed for use in glaucoma patients to have satisfactory psychometric properties.[16]

The purpose of our study was to investigate the relationship between vision-related QOL, as measured by the GAL-9 questionnaire, and the CFI in patients with advanced glaucoma.

Methods

In this study, we included fifty patients with either known or newly diagnosed glaucoma with advanced disease involving central 10° of visual field in 30–2 test, in at least one eye. These patients attended a tertiary eye care hospital in South India, between September 2016 and May 2017. Only those subjects above 18 years of age, with the ability to communicate, were included in the study.[17,18] Patients with significant lens opacity or ocular conditions that could affect visual field results, inability to communicate, ambulatory limitations, Mini–Mental State Examination (MMSE) score ≤17 (severe cognitive impairment), and nonreliable visual field test were excluded from the study. Detailed information of the study objectives and methods was provided to all eligible subjects, and those who agreed to participate signed an informed consent form in accordance with the principles embodied in the Declaration of Helsinki. The study protocol was approved by the Institutional Ethics Committee.

All subjects underwent a complete ophthalmic examination that included best-corrected visual acuity testing, intraocular pressure, gonioscopy, and dilated fundus examination with stereoscopic biomicroscopy of the optic nerve head.

Glaucomatous optic neuropathy was defined based on slit-lamp biomicroscopic evaluation with +78D lens by glaucoma specialists using the following criteria: focal or diffuse neuroretinal rim thinning, focal or diffuse RNFL loss, or an inter-eye vertical cup-to-disc ratio asymmetry of >0.2 not explained by differences in disc size. Visual field test using (HFA, Carl Zeiss Meditec, Dublin, CA) was done for such patients and was determined to be abnormal based on Anderson's criteria. Reliability indices were defined by us as follows: false-positive rates of 25% or more and false-negative rates and fixation losses of 33% or more. The patients with at least one point depressed below $P < 0.05$ in the 16 central points in 30–2 HFA were assessed for CFI calculation in 10–2 test using SITA-standard strategy. The CFI was calculated for each field as described by de Moraes *et al*.[13] using a calculator designed by us on MS Excel, based on the principles of calculating VFI described by Bengtsson and Heijl.[14] Test locations on the 10–2 pattern deviation probability plot at $P < 0.05$ were deemed abnormal and the remainder normal. Normal test locations automatically were given a score of 100%. For abnormal locations, the following equation was used to calculate the age-corrected sensitivity remaining at that location as a percentage of the expected age-corrected normal sensitivity.

100– ([|total deviation|/age corrected normal threshold] ×100); where | total deviation | corresponds to the absolute value of the total deviation from normal age-corrected sensitivity of the corresponding location on the total deviation plot and the age-corrected normal threshold represents the expected value of the normal age-corrected sensitivity (based on the normative database). The pattern deviation probability plot becomes less useful in cases of severe and diffuse loss of sensitivity where even the 85th percentile most sensitive point is severely depressed, in eyes with a mean deviation (MD) worse than −20 dB. In such cases, the definition of normal and abnormal test locations become based on the total deviation probability plots instead of the pattern deviation probability plots. A weighting procedure as described by de Moraes *et al*. was performed.[13] The 10–2 printout was divided into three concentric rings and the central-most ring (2 degrees of eccentricity) was given a weight of 8.0, the second ring, a weight of 2.5, and the outermost ring, a weight of 2.0. Finally, the weighted averages of the CFI value of all 68 test locations of the 10–2 visual field printout were calculated for each individual visual field examination to obtain a global index ranging from 0% (central blindness) to 100% (normal central vision).

The patients were interviewed by the principal investigator and asked to score the level of difficulty they have in the various tasks of the GAL-9 questionnaire. To make sure that the cognitive function of the patients does not interfere with the responses to the GAL-9 questionnaire, patients' cognition was assessed using the Mini-Mental State Examination, and patients with severe cognitive impairment (MMSE score ≤17) were excluded from the study. The composite score as well as the subscores were noted for each patient. The visual acuity of both eyes and visual field data of central 10–2 field test were also recorded.

Glaucoma activity limitation-9 questionnaire

It has nine specific activities of daily living, namely, walking after dark, seeing at night, walking on uneven ground, adjusting to dim lights, going from light to dark room and vice versa, seeing objects coming from the side, walking on steps/stairs, judging distance of foot to step/curb, and finding dropped objects. Each has to be scored depending on the level of difficulty faced from 1 to 5 (1 being "no difficulty" and 5 being "severe difficulty"), with the refractive correction on.

Mini–Mental State Examination

The MMSE is a tool developed by Folstein *et al*. that can be used to systematically and thoroughly assess mental status.[17] It is an 11-question measure that tests five areas of cognitive function: orientation, registration, attention and calculation, recall, and language. The maximum score is 30. A score of 23 or lower is indicative of cognitive impairment and 17 or lower of severe cognitive impairment. The MMSE takes only 5–10 min to administer and is therefore practical to use routinely.[18]

Statistical analysis

Pearson and Spearman correlation tests were done to assess the relationship of CFI with GAL-9 score and subscores, visual acuity, and other 10–2 HFA parameters. MS Excel was used for preparing graphs and SPSS software (version 23.0; IBM, New York, USA) was used for statistical analyses.

Results

The clinical characteristics of the study participants are shown in Table 1. The mean age of the patients was 63.54 years (range: 22–81 years) with 32 males and 18 female patients. Mean logMAR visual acuity in better eye was 0.11 ± 0.13 (range: 0–0.6) and in worse eye 0.23 ± 0.25 (range: 0–0.54). The mean composite GAL-9 score for difficulty in various tasks was 18.68 (range: 9–36) with least difficulty score for "judging distance of foot to step/curb" and "finding dropped objects" and maximum difficulty score for "walking on uneven ground" and "seeing objects coming from the side."

Table 1: Clinical characteristics in study participants

Clinical characteristics	Mean values
Age	63.54±12.35
Male: female	32:18
LogMAR VA better eye	0.11±0.13
LogMAR VA worse eye	0.23±0.25
GAL-9 scores	
Composite	18.68±7.32
Walking after dark	1.98±0.99
Seeing at night	1.86±1.01
Walking on uneven ground	2.6±1.28
Adjusting to dim lights	2.34±1.14
Going from light to dark room and vice versa	2.14±1.18
Seeing objects coming from the side	2.56±1.34
Walking on step/stairs	1.98±1.06
Judging distance of foot to step/curb	1.6±0.73
Finding dropped objects	1.62±1.09

VA: Visual acuity, GAL-9: Glaucoma activity limitation 9 questionnaire

The mean CFI was 78.82 ± 25.72% (range: 19% to 100%) in the better eyes and 40.46 ± 25.44% (range: 4% to 90%) in the worse eyes. The average of mean CFI of both eyes was 59.64 ± 21.60%. The mean MD of the central 10–2 fields in better eyes was −8.73 ± 8.49 dB (range: −0.86 dB to −29.5 dB) and pattern standard deviation (PSD) 5.92 ± 5.15 dB. In the worse eyes, the mean MD was −21.48 ± 8.05 dB (range: −3.72 dB to −32.85 dB) and PSD was 9.49 ± 3.17 dB.

GAL-9 score correlated most closely (negatively) with mean CFI of both eyes, followed by CFI of better eye and visual acuity of better eye [Tables 2 and 3]. Among the subscores, visual acuity of better eye had closest negative correlation with "walking after dark" (−0.572, CI: −0.752 to-0.386, $P < 0.0001$) and "seeing at night" (−0.557, CI: −0.711 to − 0.307, $P < 0.0001$); least correlation with "adjusting to dim lights" (−0.084, CI: −0.3541–0.1990, $P = 0.562$); and "walking on steps/stairs" (−0.102, CI: −0.434–0.106, $P = 0.482$). Visual acuity of worse eye did not correlate well with either composite GAL-9 score or any of the subscores except "judging distance of foot to step/curb."

Among the 10–2 HFA parameters, difficulty for "finding dropped objects" correlated most closely with all three parameters of better eye, namely, MD (−0.634, $P < 0.0001$), PSD (0.574, $P < 0.0001$), and CFI (−0.544, $P < 0.0001$). "Seeing at night," "walking after dark," and "walking on uneven ground" also showed moderate correlation with all the three 10–2 HFA parameters as seen in Tables 3 and 4. "Adjusting to dim lights" had weakest correlation with CFI and other 10–2 HFA parameters.

Fig. 1 shows a decrease in GAL-9 difficulty score with higher CFI in better eye as well as worse eye, with the better eye score showing a more uniform decline than the worse eye. Patients with higher CFI, especially in worse eye, showed least GAL-9

Table 2: Association between Humphrey field analyzer 10-2 parameters and glaucoma activity limitation-9 scores

GAL-9 parameters	CFI (10-2)		Mean CFI*
	Better eye*	Worse eye*	
Composite	−0.431 (0.002, CI:-0.619-–0.173)	−0.342 (0.015, CI:-0.575-–0.058)	−0.462 (0.001, CI:-0.639-–0.237)
Walking after dark	−0.426 (0.002, CI:-0.652-–0.204)	−0.245 (0.086, CI:-0.490-0.0355)	−0.413 (0.003, CI:-0.625-–0.180)
Seeing at night	−0.392 (0.005, CI:-0.641-–`0.186)	−0.257 (0.071, CI:-0.500-0.0228)	−0.382 (0.006, CI:-0.626-–0.111)
Walking on uneven ground	−0.500 (<0.0001, CI:-0.6830-–0.2570)	−0.323 (0.022, CI:-0.5713-–0.07753)	−0.502 (<0.0001, CI:-0.677-–0.263)
Adjusting to dim lights	−0.052 (0.718, CI:-0.3260-0.2293)	−0.168 (0.243, CI:-0.4518-0.0846)	−0.147 (0.309, CI:-0.415-0.160)
Going from light to dark room and vice versa	−0.322 (0.022, CI:-0.544-–0.0376)	−0.261 (0.068, CI:-0.502-0.0192)	−0.327 (0.020, CI:-0.592-–0.061)
Seeing objects coming from the side	−0.122 (0.400, CI:-0.407-0.139)	−0.285 (0.045, CI:-0.522-–0.0074)	−0.246 (0.085, CI:-0.488-0.004)
Walking on step/stairs	−0.360 (0.010, CI:-0.486-0.0406)	−0.211 (0.142, CI:-0.462-0.0717)	−0.346 (0.014, CI:-0.609-–0.014)
Judging distance of foot to step/curb	−0.164 (0.255, CI:-0.4231-0.1198)	−0.300 (0.034, CI:-0.5071-0.0129)	−0.256 (0.073, CI:-0.495 - -0.020)
Finding dropped objects	−0.544 (<0.0001, CI:-0.676-–0.332)	−0.264 (0.064, CI:-0.5736-–0.0809)	−0.468 (0.001, CI:-0.618-0.324)

*Values denote correlation coefficient (*r*) with *P* value and CI in parenthesis. CFI: Central Field Index; CI: Confidence interval, GAL-9: Glaucoma activity limitation-9

Table 3: Correlation between visual acuity and glaucoma activity limitation-9 scores

GAL-9 parameters	VA better eye*	VA worse eye*
Composite	−0.398 (0.004, CI:-0.577-−0.210)	−0.188 (0.192, CI:-0.475-0.100)
Walking after dark	−0.572 (<0.0001, CI:-0.752-−0.386)	−0.185 (0.198, CI:-0.468-0.0639)
Seeing at night	−0.557 (<0.0001, CI:-0.711-−0.307)	−0.197 (0.170, CI:-0.471-0.0604)
Walking on uneven ground	−0.387 (0.006, CI:-0.6005-−0.1215)	−0.078 (0.588, CI:-0.3491-0.2044)
Adjusting to dim lights	−0.084 (0.562, CI:-0.3541-0.1990)	−0.126 (0.384, CI:-0.3905-0.1580)
Going from light to dark room and vice versa	−0.197 (0.171, CI:-0.513-0.064)	−0.159 (0.269, CI:-0.401-0.146)
Seeing objects coming from the side	−0.196 (0.172, CI:-0.466-0.0669)	−0.178 (0.215, CI:-0.376-0.1534)
Walking on step/stairs	−0.102 (0.482, CI:-0.434-0.106)	−0.018 (0.903, CI:-0.300-0.256)
Judging distance of foot to step/curb	−0.397 (0.004, CI:-0.630-0.178)	−0.408 (0.003, CI:-0.659-−0.088)
Finding dropped objects	−0.227 (0.051, CI:-0.555-−0.0541)	−0.037 (0.799, CI:-0.339-0.216)

*Values denote correlation coefficient (*r*) with *P* value and CI in parenthesis. GAL-9: Glaucoma activity limitation-9; VA: Visual acuity, CI: Confidence interval

Table 4: Correlation of mean deviation and pattern standard deviation of Humphrey field analyzer 10-2 with Glaucoma Activity Limitation-9 scores

GAL-9 parameters	MD (10-2)		PSD (10-2)	
	Better eye*	Worse eye*	Better eye*	Worse eye*
Composite	−0.345 (0.014, CI:-0.556-−0.069)	−0.346 (0.014, CI:-0.578-−0.063)	0.280 (0.048, CI:-0.022-0.519)	0.106 (0.464, CI:-0.155 to 0.350)
Walking after dark	−0.411 (0.003, CI:-0.608-−0.178)	−0.227 (0.112, CI:-0.475-0.043)	0.377 (0.007, CI: 0.127-0.594)	0.131 (0.366, CI:-0.102 to 0.365)
Seeing at night	−0.404 (0.004, CI:-0.618-−0.147)	−0.244 (0.088, CI:-0.502-0.066)	0.359 (0.010, CI: 0.095-0.588)	−0.019 (0.894, CI:-0.284 to 0.282)
Walking on uneven ground	−0.369 (0.008, CI:-0.580-−0.087)	−0.341 (0.015, CI:-0.586-−0.025)	0.333 (0.018, CI: 0.064-0.544)	0.156 (0.280, CI:-0.106 to 0.394)
Adjusting to dim lights	0.001 (0.992, CI:-0.288-0.306)	−0.175 (0.225, CI:-0.433-0.113)	−0.060 (0.679, CI:-0.349-0.241)	0.097 (0.504, CI:-0.196 to 0.367)
Going from light to dark room and vice versa	−0.313 (0.027, CI:-0.567--0.023)	−0.269 (0.059, CI:-0.516-0.023)	0.243 (0.089, CI:-0.036-0.496)	0.084 (0.562, CI:-0.176 to 0.340)
Seeing objects coming from the side	−0.082 (0.570, CI:-0.336-0.160)	−0.285 (0.045, CI:-0.530-0.007)	0.085 (0.559, CI:-0.176-0.352)	0.072 (0.618, CI:-0.203 to 0.346)
Walking on step/stairs	−0.220 (0.125, CI:-0.499-0.104)	−0.226 (0.115, CI:-0.503-0.089)	0.078 (0.592, CI:-0.184-0.330)	0.028 (0.848, CI:-0.268 to 0.319)
Judging distance of foot to step/curb	−0.249 (0.081, CI:-0.504-0.019)	−0.301 (0.034, CI:-0.525-−0.036)	0.278 (0.051, CI: 0.017-0.542)	0.049 (0.733, CI:-0.238 to 0.281)
Finding dropped objects	−0.634 (<0.0001, CI:-0.762-−0.456)	−0.246 (0.085, CI:-0.480-0.034)	0.574 (<0.0001, CI:-0.375-0.738)	0.087 (0.549, CI:-0.177 to 0.346)

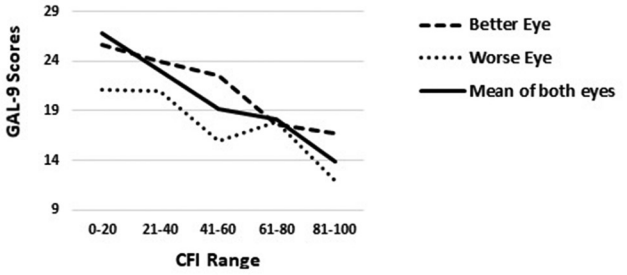
*Values denote correlation coefficient (*r*) with *P* value and CI in parenthesis. CI: Confidence interval, GAL-9: Glaucoma activity limitation-9, MD: Mean deviation, PSD: Pattern standard deviation

difficulty score. It was also noted that Composite GAL-9 score decreased significantly when CFI of better eye was <60%, when compared to CFI of better eye being >60% ($P = 0.003$ using independent samples *t*-test).

Discussion

Our study involved a newly devised index of the HFA central 10–2 – the CFI. The purpose was to analyze how QOL is affected in patients with advanced glaucoma and to try to find the correlation between the remaining central field of vision and the QOL to better understand what difficulties such patients actually face in daily activities. This could help us take better supportive care of patients with advanced glaucoma and plan more specific rehabilitative treatment.

The mean CFI in the better eye of the patients was nearly double that of the worse eye. The MD in the worse eye was reduced compared to the better eye, indicating advanced glaucomatous damage affecting the central 10° field of one eye more than the other. The mean composite GAL-9 difficulty score was 18.68 out of 45 which meant that despite having advanced glaucoma in at least one eye, the patients perceived only "little difficulty" in their daily activities. This indicates that the patients depended more on the better eye for day-to-day activities. Walking on uneven ground and seeing objects coming from sides were found to be the most difficult tasks in our study group. Activities with least difficulty were judging distance of foot to step and finding dropped objects. We saw that the patients had well maintained visual acuity despite advanced glaucoma in one or both eyes. GAL-9 score



Numerical data for Figure 1: Mean GAL score over CFI range

CFI range	Mean GAL score		
	Better eye (*n*)	Worse eye (*n*)	Mean of both eyes (*n*)
0-20	25.67 (3)	21.07 (15)	26.75 (4)
21-40	24.00 (3)	21.00 (12)	23.00 (3)
41-60	22.50 (8)	15.91 (11)	19.12 (17)
61-80	17.60 (5)	17.88 (8)	18.12 (17)
81-100	16.68 (31)	12.00 (4)	13.89 (9)

Note that the minimum score in GAL-9 questionnaire (best score) is 9.
CFI: Central Field Index, GAL: Glaucoma activity limitation

Figure 1: Line diagram showing the relationship between different ranges of Central Field Index of better eye, worse eye, and mean Central Field Index of both eyes with glaucoma activity limitation-9 scores

had a moderate negative correlation with visual acuity of the better eye, compared to a weak correlation with the worse eye visual acuity. Among the individual tasks also, the better eye visual acuity correlated more than the worse eye; strongly for "walking after dark" and "seeing at night."

GAL-9 score correlated more with the CFI of the better eye than the worse eye. Tasks such as "finding dropped objects" and "walking on uneven ground" correlated strongly with CFI of better eye. "Adjusting to dim lights," "seeing objects coming from sides," and "judging distance of foot to step" showed no correlation with CFI. Tasks more strongly correlating to CFI may be more dependent on central visual field. Tasks that did not show a significant correlation to CFI may be more dependent on peripheral field of vision. CFI showed a stronger correlation to GAL-9 score than MD and PSD which may be due to the fact that CFI is a more specific glaucoma index than others.[13]

On grouping the patients based on CFI as shown in Fig. 1, we found a gradual decrease in the GAL scores with increasing CFI, or in other words, the difficulty in performing daily activities increased as the central field diminished. This relationship was more uniform for the better eye CFI and the average of both eyes' CFI than the worse eye CFI. GAL-9 or daily activities are determined by the status of both the eyes. If one eye performs better than the other, the ease of daily activities tends to depend on that eye, as seen in the results of our study. This also explains why the average CFI of the two eyes combined showed similar correlation with GAL-9 composite and subscores as the better eye alone. As a routine, binocular fields such as Esterman's are not tested for glaucoma patients and there is no software yet in the HFA to calculate binocular field from routinely tested monocular programs.[19] This limitation may be partially overcome by calculating the combined CFI of both eyes to get an estimate of the binocular field.

From these findings, it is clear that, the better eye had more influence on the QOL of patients of advanced glaucoma than the worse eye. Even with severe reduction in central visual field in one eye, patients can manage to do most of their daily activities with little difficulty. Previous studies have also evaluated QOL in glaucoma patients using the various questionnaires and their relationship with visual function of patients.[3,20-22] Wandell *et al.* concluded that health-related QOL in glaucoma patients in general is good, especially when vision is intact.[20] Choudhury *et al.* also showed that participants with any central VF loss had lower NEI-VFQ-25 scores than those with unilateral or bilateral peripheral VF loss.[23] In our study also, even though the field defects encroached on the central 10°, the overall GAL difficulty score was low, for which the good visual acuity might be responsible.

Studies have shown that the better functioning eye has a stronger relation with QOL than the worse eye.[20,21] Our study is in agreement with this as CFI and visual acuity of the better eye, both showed a stronger correlation with GAL-9 score than the worse eye. Hirooka *et al.* in contrast reported that the worse eye had a slightly closer relationship with QOL than better eye.[24] Among CFI and visual acuity, CFI showed a stronger relationship with GAL-9 score. CFI was devised on principles of VFI and thus is more specific for glaucomatous field defects than MD in 10–2 visual field analysis.[13] In our study, CFI of better eye showed a stronger correlation to GAL-9 score than MD. This shows that CFI predicts the QOL in glaucoma patients in terms of day-to-day activity limitation better than MD on a 10-2 HFA.

Our study had certain limitations. GAL-9 questionnaire being a subjective measure may not be truly reflective of the QOL experienced by the patients. It may be influenced by the individual perception of patients about themselves and the disease, as well as by the mode of administration of the questionnaire (self or interviewer-administered). Another limitation was that patients with different types of glaucomas were included in our study such as primary open angle glaucoma, normal tension glaucoma, primary angle closure glaucoma, and secondary glaucomas. The various types of glaucomas may affect the visual field differently and thus have different effects on patients' QOL. In future studies, it would be interesting to evaluate the relationship of VFI along with CFI when studying the QOL in glaucoma patients.

Conclusion

We can say that the CFI has a significant relationship with the limitation of daily activities due to glaucoma. In patients with advanced glaucoma where central 10° of the field is involved, the CFI can be a good predictor of the glaucoma-related deterioration in QOL. At CFI <60% in better eye, the difficulty in performing daily activities may significantly increase. Patients can manage their day-to-day activities reasonably well even when one eye is severely affected if the other eye has good central vision. The aim of glaucoma treatment is to preserve the QOL of patients and CFI can help us understand and monitor this during treatment.

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Conflicts of interest

There are no conflicts of interest.

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