Original Article

Correlation Between Health-Related Quality of Life Scores and Measures of Visual Function in an Abuja Cohort of Primary Open Angle Glaucoma Patients

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Abstract

Background: This study aims to correlate quality of life measures with visual function parameters and to determine the visual function parameters that independently affect the quality of Life in primary open angle glaucoma patients (POAG) in Abuja.

Methodology: A cross sectional study carried out among 106 POAG patients attending Asokoro District Hospital, Abuja and Eye Foundation Hospital Abuja from Nov 2012 to April 2013. National Eye Institute Visual Function Questionnaire 25 (NEIVFQ25) and Glaucoma Symptom Scale (GSS) were used to assess Quality of Life (QoL) after biodata was obtained. The objective measures of visual function assessed include: visual acuity (VA), contrast sensitivity (CS), colour vision (CV) and visual fields (Mean Deviation). Data was analysed using SPSS Version 20 using Spearman Rho Correlation and linear regression.

Results: There was a strong correlation between the NEIVFQ25 scores and all the measures of visual function. There was also a strong correlation between GSS and contrast sensitivity in both eyes, and mean deviation of the better eye while the others showed a moderate correlation with the scale. On multivariate analysis of the NEIVFQ25 scores by visual function, the independent visual functions that affects the NEIVFQ25 QoL measures were the visual acuity better eye and contrast sensitivity better eye. Contrast sensitivity in the better eye had a stronger correlation than visual acuity in the better eye. On multivariate analysis of GSS scores by visual function parameters, contrast sensitivity in the better and worse eye were the independent visual function parameters that affect the GSS. The contrast sensitivity of the better eye had a stronger correlation with NEIVFQ25 and GSS.

Conclusion: The study revealed the impact of contrast sensitivity on the quality of life and glaucoma symptoms the patients have. It is important that measures of contrast sensitivity be incorporated into evaluating glaucoma patients.

Keywords: Quality Of Life; Visual Function; Visual Acuity; Visual Field; Contrast Sensitivity; Colour Vision .

Key Messages: Contrast sensitivity of the better eye was the visual function parameter that affected the vision related quality of life scale the most.

Introduction

Glaucoma can be defined as a group of diseases with a progressive optic neuropathy associated

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with loss of retinal ganglion cells and retinal nerve fibre layer defects resulting in a characteristic appearance of the optic disc and corresponding visual field defects that are associated frequently with but not invariably with a raised intraocular pressure[1]. It is well documented that glaucoma is a leading cause of visual impairment and blindness worldwide and in Nigeria [2,3]. In Nigeria it accounts for 16.7% of blindness, giving a prevalence of 0.7%, amongst people of 40 years and above [3].

Glaucoma initially affects peripheral vision and late in the disease affects central vision and then leads to blindness. Glaucoma has been found to affect visual function and quality of life of patients at a much earlier stage of the disease than what was previously assumed, that these measures are only affected in the late stages [4,5,6].

There are various measures of visual function such as visual acuity, contrast sensitivity, colour vision, light and dark adaptation, stereopsis and visual field to mention but a few. It is important to understand how these measures actually affects QoL and which of these measures independently affects quality of Life. Also, it is important to have a better understanding as to which eye (the better or worse eye) of these various visual functions affects quality of life more.

A few studies in Nigeria have reported the correlation between quality of Life and visual function.

These studies showed a moderate to strong correlation between visual function measures and quality of Life[5,4,6]. The better eye VA correlated more than the worse eye VA with the NEIVFQ25 scale amongst POAG patients in Lagos [7]. The reverse was the case among POAG patients in Benin [4] where worse eye Logmar VA correlated more with the NEIVFQ. Gutirrez et al [8] and some other studies [9,10] reported visual field defects in the better eye correlating more with NEIVFQ than the worse eye. Hideko et al found that visual acuity and central 10 Degree MD value in the better eye and central 30-degree MD value in the worse eye were highly correlated with NEIVFQ[6]. Jampel et al did not find a difference between both eyes [11].

The study aims to correlate quality of life measures with visual function and to ascertain the visual function parameters that independently affect the quality of Life. The study also aims to explain the relationship between the quality of Life and better or worse eye.

Subjects and Methods

Study design: The study was a multicentre cross-sectional study, carried out from November 2012 to April 2013, based on a null hypothesis that there is no correlation between quality of life and visual function.

Study Population: POAG patients attending Asokoro District Hospital, Asokoro and Eye Foundation Hospital, Abuja from November 2012 to April 2013.

Sampling Technique: Purposive sampling technique was used to select Asokoro District Hospital, Asokoro and Eye Foundation Hospital, Abuja because of their high volume of glaucoma patients and access to the automated visual field.

Ethical approval: The study adhered to the tenets of the Declaration of Helsinki. Ethical approval was obtained from FCT Health Research Ethics committee, Research Ethics Committee Asokoro District Hospital and the Research Ethics Committee Eye Foundation Hospital. Permission was sought from the Chief Medical Directors and Head of Departments of both institutions. Each patient who agreed to participate, read the patient participation sheet and signed a consent form.

A sample size of 106 cases was adopted for this study, based on the formula of $n=Z2pq/d$[12] with 20% allowance for attrition. A prevalence of POAG of 6.1% was used based on the prevalence of POAG in adults above 40 years [13] in Akinyele LGA of Oyo state.

Consecutive patients with Primary Open Angle Glaucoma above the age of 40 years that fit into the requirement for eligible participants were enrolled into the study. The participants were evenly distributed between both hospitals.

Primary open-angle glaucoma patients in the study were defined as patients with gonioscopically open anterior chamber angles, glaucomatous optic nerve head changes (vertical cup to disc ratio of greater than or equal to 0.5 with violation of the ISNT rule or disc asymmetry of greater than 0.2) and corresponding visual field defects in the absence of other identifiable causes. Elevation of intra-ocular pressure was not considered in this definition [14,15].

Eligibility Criteria

POAG patients who were at least 40 years of age at diagnosis, had been diagnosed for at least three months, who were on medical therapy or had trabeculectomy at least 3 months before the study, with a reliable automated visual field in at least 1 eye within the past 6 months in their medical records and consented to participate in the study were included in the study. Patients who did not fit into these criteria, had any other form of glaucoma or optic neuropathy other than POAG or had central nervous system, cognitive, hearing or mobility impairment were excluded from the study.

A detailed history and examination of consecutive patient was done. Detailed examination which involved visual acuity, intraocular pressure measured with Goldman's Applanation Tonometry, slit lamp anterior segment examination, dilated fundoscopy and 78D assessment of the optic nerve head were carried out. Details of the study were explained to selected participants, permission was sought and a written consent was obtained. All participants were then given a study number. The objective measures of visual function were then carried out. Visual Acuity was assessed using Illuminated Snellen's chart for literate participants or Illiterate E chart for illiterate participants. The Snellen's visual acuity was converted to logarithm of Minimum Angles of Resolution (log MAR) notation. Assessment of contrast sensitivity was done using the online version of the Pelli Robson Chart. The scoring system provides0.15 credits per triplet if at least two of three letters are read correctly. Scores on the Pelli-Robson chart can range from 0 to 2.25 (corresponding to log contrast sensitivity) kindly note that increasing value indicates increasing contrast sensitivity. Assessment of color vision was done using online version of the City University Color Vision Test [16].

Central visual field was measured in each eye using the Humphrey Field Analyzer II (Swedish interactive thresholding algorithm standard 24-2) (Carl Zeiss Meditec model 750i). Reliable visual field was defined as fixation losses less than 20%, and false negative and positive negative less than 33%. The participants without a reliable visual field in the last 6 months were then given a date and time between 8 and 12 am spread across the five working days to return for a visual field test. Perimetry was carried out by a trained perimetrist. The mean deviation of both eyes was obtained and analyzed separately.

The Quality - of -Life questionnaire was administered through an interview session in English and the three Nigerian languages (Igbo, Yoruba and Hausa) depending on which the patient was fluent with and was carried out by 2 trained research assistants that were blinded from the participants. The two-research assistant were fluent in all four languages.

Quality of Life Assessment

A multidimensional approach was used to assess two domains of QoL, the functional status and impairment domains. This was carried out by two research assistants who were blinded from the patients.

Impairment: i.e., subjective symptoms of disease and treatment was assessed using the Glaucoma Symptom Scale (GSS)

Functional status: i.e. acute or chronic limitations in physical, psychological, or social functioning;

- physical/functional (activities of daily living, mobility),
- social (interpersonal contacts and relationships) and
- psychological (mental health, emotional balance)

The NEIVFQ25 was used to assess functional Status.

Disease specific impairment

The GSS was used to quantify, impairment arising from symptoms of glaucoma and its treatment. The GSS is a modified version of the Ocular

Hypertension Treatment Study (OHTS) symptom checklist [17]. The items include 10 ocular complaints that are often associated with glaucoma and it's treatments: burning/smarting/stinging, tearing, dryness, itching, soreness/tiredness, feeling of something in the eye, blurry/dim vision, hard to see in daylight, hard to see in dark places, and halos around lights. The first 6 items consist of non-visual ocular symptoms, whereas the last 4 items consist of visual ocular complaints. The 10 items of the checklist query each eye separately and consist of a 4-level bothersome scale for those who reported having a given symptom. For each eye, a 5-level score is generated, ranging from 0 (complaint present and very bothersome) to 4 (complaint absent). This score is then transformed to a 0 to 100 scale, with 0 representing presence of a very bothersome problem and 100 representing absence of a problem. The final GSS score is an un-weighted average of the responses to all 10 items, averaged between the 2 eyes.

Disease-specific functional status

The 25 item National Eye Institute Visual Function Questionnaire (NEIVFQ25) designed by Research and Development Corporation was used to assess the disease specific functional status.

The NEIVFQ25 includes subscale to assess general health[1], general vision[1], ocular pain[2], near vision activities[3], distance vision activities[3], social functioning[2], vision-specific role difficulties[2], vision-specific mental health[4], dependency because of vision[3], driving[2], peripheral vision[1], and colour vision[1]. Item responses were transformed to a scale of 0 to 100. The overall NEI-VFQ-25 score was calculated as the average of the 25 items, whereas the subscale scores were the averages of the responses to items within each subscale. Both the overall and subscale scores range from 0 to 100, with higher scores indicating better vision-targeted HR-QOL[1].

Data Entry and Statistical Analysis

Data entry, editing and analysis was done using SPSS (Software Programme for Social Sciences version 20.) Spearman Rho correlation was used to correlate the visual function and health related quality of life assessment parameters. Univariate and Multivariate Linear regression was used to determine the visual function measures that had an independent statistically significant relationship with the quality-of-Life measures.

Results

A total of 106 participants were enrolled into the study, consisting of 68 males and 38 females. Their ages ranged from 40 to 88 with a mean age of 55.2 years.

Table1: Correlation between Health Related Qol Scores and Measures of Visual Function

	NEIVFQ25	GSS
Logmar Visual Acuity BE	-0.721(<0.001)	-0.413(<0.001)
Logmar Visual Acuity WE	-0.686(<0.001)	-0.512(<0.001)
Mean Deviation BE	0.662(<0.001)	0.565(<0.001)
Mean Deviation WE	0.648(<0.001)	0.499(<0.001)
Contrast sensitivity BE	0.759(<0.001)	0.580(<0.001)
Contrast sensitivity WE	0.692(<0.001)	0.586(<0.001)

A correlation value of < 0.31 shows a modest correlation, 0.32 to 0.55 shows a moderate correlation and >0.55 shows a strong correlation. P-value in parenthesis. The correlations are significant at the 0.01 level-99% degree of confidence. BE: better eye, WE: worse eye, GSS: Glaucoma Symptom Scale, NEIVFQ25: National Eye Institute Vision Function Questionnaire 25. Spearman Rho correlation was used.

There was a strong correlation between the NEIVFQ and all the measures of visual function.

There was strong correlation between GSS and contrast sensitivity in both eyes, and mean deviation of the better eye while the others showed a moderate correlation with the scale.

The better eye had a stronger correlation than the worse eye when correlating NEIVFQ with all measures of visual function. The GSS had the worse eye having a stronger correlation than the better eye for visual acuity and contrast sensitivity and the better eye having a stronger correlation for visual field.

Table 2: Univariate and Multivariate Linear Regression of NEIVFQ25 scores by Objective Measures of Vision

	Univariate analysis		Multivariate analysis	
	Beta Coefficient	P value	Beta Coefficient	P value
Visual acuity better eye	-0.712	<0.001**	-0.330	<0.001**
Visual acuity worse eye	-0.040	0.684	0.010	0.861
Contrast sensitivity better eye	0.759	<0.001**	0.353	<0.001**
Contrast sensitivity worse eye	0.692	<0.001**	0.184	0.055
Mean deviation better eye	0.662	<0.001**	0.176	0.532
Mean deviation worse eye	0.648	<0.001**	0.146	0.654
Color vision right eye	0.559	<0.001**	0.076	0.474
Color vision left eye	0.545	<0.001**	0.168	0.100

NEIVFQ25: National Eye Institute Visual Function Questionnaire 25. **P-values <0.05 shows statistically significant relationship.

Univariate linear regression of the NEIVFQ25 scores by visual function showed all clinical variables had a statistically significant relationship except visual acuity worse eye. On multivariate analysis the visual acuity better eye and contrast sensitivity better eye were found to have a statistically significant relationship. Contrast sensitivity better eye had a stronger B coefficient than visual acuity better eye.

Table 3: Univariate and Multivariate Linear Regression of GSS scores by Objective Measures of Vision

	Univariate analysis		Multivariate analysis	
	Beta Coefficient	P value	Beta Coefficient	P value
Visual acuity better eye	-0.403	<0.001**	0.055	0.619
Visual acuity worse eye	-0.033	0.737	0.013	0.865
Contrast sensitivity better eye	0.580	<0.001**	0.392	0.004**
Contrast sensitivity worse eye	0.586	<0.001**	0.373	0.005**
Mean deviation better eye	0.565	<0.001**	0.234	0.473
Mean deviation worse eye	0.499	<0.001**	0.275	0.469
Color vision right eye	0.397	<0.001**	0.153	0.291
Color vision left eye	0.412	<0.001**	0.098	0.478

GSS: Glaucoma Symptom Scale. **P-values <0.05 shows statistically significant relationship.

Univariate linear regression of GSS scores by clinical visual function parameters showed all clinical variables had a statistically significant relationship except visual acuity worse eye. On multivariate analysis contrast sensitivity in the better and worse eye were found to be significant in affecting the GSS scale. The contrast sensitivity of the better eye had a stronger B coefficient.

Discussion

There was a moderate to strong correlation between visual function and QoL measures, hence buttressing the need for early diagnosis, adequate and continuous counselling, effective monitoring of the glaucoma patient to prevent any further deterioration in visual function in order to preserve and improve their quality of life, as any further deterioration will worsen vision related QoL. Similar findings of the correlation between visual function and QoL were seen amongst patients in LUTH [7], UBTH [4] and Japan [6].

We explored the correlation between visual function in the better and worse eye to determine which eye contributes more to the QoL. We found the better eye had a stronger correlation than the worse eye with the functional status (NEIVFQ) with all measures of visual function. These parameters measure the activities of daily life, and suggest that deterioration to the better eye leads to more impairment of daily task probably because the patient will notice the deterioration more. Similar findings were documented among patients seen in LUTH [7] where the correlation between the visual acuity and NEIVFQ25 was stronger with the better eye than the worse eye. The reverse was the case as reported by Iyasele [4] where worse eye Log mar VA correlated more with the NEIVFQ [4]. Iyasele's study did not adjust for age unlike the other studies.

Gutirrez et al[8] and some other studies[9,10] found similar findings as ours with visual field defects in the better eye correlating more with NEIVFQ than the worse eye. Hideko et al found that visual acuity and central 10 Degree MD value in the better eye and central 30 degree MD value in the worse eye were highly correlated with NEIVFQ which implies

that central vision related QOL depends on the better eye whereas the peripheral vision related quality of life may depend on the worse eye [6], although in our study we used 24 degree MD value and found the better eye to have a stronger correlation with NEIVFQ. Jampel et al did not find a difference between both eyes[11]. The role of the better eye, worse eye is not fully understood and further studies are required to reach a conclusion [6]. However, it makes sense for the better eye to correlate more than the worse eye with QOL measures because that is the eye that reflects the quality of a patient's vision and visual impairment is defined using best corrected visual acuity (BCVA) in the better eye.

For the NEIVFQ25 the correlation with visual function was higher for contrast sensitivity and visual acuity than mean deviation (MD) probably because patients are more aware of changes in visual acuity and contrast sensitivity and these affect their daily life than the subtle changes that occur with the visual field. Similar findings were documented by Mbadugha [7]. It is also worthy to note that contrast sensitivity had the highest correlation with the scale. We routinely carry out visual acuity, but this study shows us that contrast sensitivity would tell us more about the quality of life of our patients.

Using a linear regression univariate analysis showed that all measures of visual function were found to have a statistically significant relationship with NEIVFQ25 except visual acuity worse eye. A multivariate analysis was carried out to actually determine which visual function independently affects the quality of life of these patients as measured by the NEIVFQ. It was found that contrast sensitivity in the better eye and visual acuity in the better eye filled this criteria. However, contrast sensitivity was found to have a stronger B coefficient and so it impacts the Qol more than the visual acuity.

With the Glaucoma Symptom scale, the worse eye had a stronger correlation for visual acuity and contrast sensitivity probably because it is a scale of symptoms and the worse eye will have more symptoms. Contrast sensitivity in the better eye and worse eye showed a better correlation with the Glaucoma symptom scale than visual acuity. This suggests that contrast sensitivity probably accounts for majority of the symptoms that glaucoma patients encounter.

The independent visual function that contributes to the GSS Quality of Life measure is the contrast sensitivity in both eyes. The contrast sensitivity in the better eye was found to have a stronger relationship.

These showed the impact that contrast sensitivity has on the quality of life. It is important that measures of contrast sensitivity be incorporated into evaluating glaucoma patients.

The strengths of the study were that it was a multicentre study involving a public and private hospital, giving a more diverse picture. Multidimensional quality of life assessments were used. Objective measures were assessed solely by one person to reduce inter-observer error. A multivariate linear regression was carried out to actually ascertain the visual function measures that independently affects the quality of life. The limitations of the study are the small size and the opportunistic sampling technique, therefore the findings may not be easily generalisable into the general population of the Federal Capital Territory.

Conclusion

The study revealed the impact of contrast sensitivity on the quality of life and glaucoma symptoms the patients have. It is important that measures of contrast sensitivity be incorporated into evaluating glaucoma patients. Better eye was found to contribute more to quality of Life than the worse eye.

Recommendations from the study were contrast sensitivity evaluation should be incorporated into routine management of glaucoma patients and a protocol of continuous regular QoL assessment tools should be incorporated into our management of POAG patients as these are invaluable assessment tools.

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