Correlation between postoperativevisual acuity and patient-related outcomes in senile cataract

.

ABSTRACT

Aims: This study assessed visual function (VF) and quality of life (QOL) post cataract surgery and their relationship with post-operative presenting visual acuity (PVA) in patients operated for senile cataract in two hospitals in Jos, North-central Nigeria.
Study design: A retrospective, hospital-based, cross-sectional survey
Place and duration of study: The study took place in the Eye units of the Bingham University Teaching Hospital and the Faith Alive Foundation Hospital both in Jos, North-Central Nigeria between June and August 2021.
Methodology: Patients aged 40 years and above, operated on for senile cataract within 18 months before the onset of the study were included. Sociodemographic data and surgical history were obtained from patients and their surgical records. Visual acuity at presentation was assessed at six weeks or morepostoperative periodwith available correction using Snellen's acuity and converted to theLogMAR scale. A trained research assistant administered the VF-14 item and QOL-12 item questionnaires and responses were scored using Fletcher's guidelines.Data was analyzed with STATA version 16.0 using thegeometric mean, range, percentages, and Spearman's rank test.
Results: Eighty-seven (69.6%) participants aged 40-104 years, mean of 67.2 ± 12.0 years with a male-to-female ratio of 1.1:1 were enrolled. Their mean PVA was 0.6LogMAR (6/24) which improved to 0.3LogMAR (6/12). The mean total VF and QOL were 87.1% and 97.5% respectively. Depth perception (99.6%), visual perception, and peripheral vision (94.2% each) scored the highest in the VF subscales. Mentalwell-being (97.9%) scored the highest in the QOL subscale, followed by social interaction (97.3%). There was a negative correlation between PVA and mean total VF (r_s = -0.4, P<0.0001) and QOL (r_s = -0.3, P = 0.011).
Conclusion: In this study population, VF and QOL scores improved with increasing PVA.

Keywords: [Visual function, quality of life, cataract surgery}

1. INTRODUCTION

Cataract surgery is an efficient, cost-effective health intervention that is intended to restore apatient's vision, improve visual function (VF)/quality of life(QOL), and promote economic productivity.[1,2,3,4,5] In the recent past, the global emphasis has been on improving the cataract surgical coverage (CSC) and cataract surgical rate (CSR). However, because the quality of cataract surgery provided particularly in LMIC is not always optimal, equal attention needs to be given to not only improvingthe quantity but also the quality of cataract surgeries in developingcountries.[6,7,8] Previously, assessment of cataract surgery outcomes has been mainly through the use of objective clinical measures such as post-operative visual acuity (PPVA) and refractive error (RE) which are easier and less time-consumingto conduct in routine clinical practice. Evaluation of VF and QOL were often ignored, partly due to the assumption that they naturally will follow visual recovery. The current trend in outcome assessment, however, is to give equal attention to both clinical and patient-reported outcomes (PROs) assessment.This combined approach is increasingly being adopted by

researchers.[9,10] It is in recognition of this, that the WHO recommends monitoring cataract surgical outcomes through the use ofvision-related quality-of-life tools alongside clinical evaluation, to provide a holistic assessment.[11]

Regrettably, there is still a paucity of data regarding how clinical outcomes correlate with PROs from developing countries. Reliable evidence from LMIC identifying factors that cause clinical and PROs of cataract surgery to be less than ideal and the specific steps that can be taken to address these factors are insufficient. This study assessed the VF and QOL post-cataract surgery in patients operated on for senile cataracts in two hospitals in Jos, North-central Nigeria, and how they relate topost-operative presenting visual acuity (PVA). Investigating the results of cataract surgery on both clinical and PROs is useful in exploring the full benefits of cataract surgery and has the potential to improve the overall quality of cataract surgical services in developing settings.

2. MATERIAL AND METHODS

The study was conducted in two faith-based hospitals in Jos, Nigeria between June and August 2021 over six weeks.

It was a retrospective, hospital-based, cross-sectional study involving patients who had been operated on for senile cataractswithin18 monthsbefore the onset of thestudy. Those excluded from the study were patients below 40 years with Secondary or complicated cataracts, who had second cataract surgery, combined procedure, were aphakic, residing outside of Jos at the time of the study, whose telephone contacts could not be retrieved from their case notes or who declined consent.
Eligible participants were identified from the surgical registers of each facility and invited for recruitment on a specified date by an ophthalmic nurse via telephone calls.At presentation, all participants were administered the patient information sheet and informed consent, and interviewed to obtain their sociodemographic data and surgical history retrieved from their surgical records. The study was conducted after obtaining ethical approval.

2.1 Patient-reported outcomes assessment

The adopted Visual function (VF) /quality of life (QOL) questionnaires were administered by a trained research assistant. The VF-14 item and QOL-12 item questionnaires wereinitially developed in India, used for a clinical trial of cataract surgery outcomes, and have been validated and used by authors in several other LMICs including Nigeria.[1,12,13,14] The VF-14 item questionnaire measures visual capacity in five subscales; general vision, visual perception, peripheral vision, sensory adaptation, and depth perception. The QOL-12 item questionnaire assesses the difficulties individuals face in everyday life because of visual loss using four subscales; self-care, mobility, social function, and mental wellbeing. First, the total cumulative score for each subscale was calculated and expressed as a percentage of the maximum possible score. Scores across all the subscales were then added together to obtain the overall VF and QOL scores. The higher the value of the score, the better the VF/QOL. Conversely, the lower the value of the score, the poorer the QOL/VF. The final score for both questionnaires was produced using the scoring system which ranges between 0 (unable to do all applicable activities) to a maximum of 100 (able to perform the activity with no difficulty at all) using Fletcher's guideline.[14]

2.2. Clinical outcome assessment

Thereafter, all patients underwent post-operative presenting visual acuity (PVA) assessment with available correction by an ophthalmic nurse and best corrected visual acuity (BCVA) assessment by an optometrist. All patients were six weeks or more post-surgery at the time of PVA assessment. Full details of PVA assessment have been elaborated in another publication related to this study.[15] The PVA assessed using Snellen's acuity was converted to the LogMAR scale by taking the log to the base of 10 of the reciprocal of Snellen's acuityfraction for statistical analysis and comparison with similar studies.[12,16]

2.3 Data analysis

Data was entered into a Microsoft Excel spreadsheet and imported into STATA version 16.0 (Stata Corp, College Station, TX, USA) for analysis using frequencies. geometric mean, percentages, Wilcoxon Sign Ranked test, and Spearman's Rank test. In all instances, a 2-sided P value set at 0.05 was regarded as statistically significant for all variables of interest.

3. RESULTS AND DISCUSSION

3.1 Results

A total of 125 patients were eligible for the study, of which 87 were enrolled giving a response rate of 69.6%. Their mean age was 67.2 ± 12.0 years with a male-to-female ratio of 1.1:1. Majority of the participants were married (57, 65.52%), had no formal education (52, 59.77%), were urban dwellers (65, 74.71%), not living alone (86, 98.85%) and engaged in petty trading (31, 35.63%). See Table 1.

Table 1: Socio-demographic characteristics of study participants

Socio-demographic characteristic	Frequency (%) n = 87
Age group (years)	
40-50	6(6.90%)
51-60	19 (21.84%)
61-70	37 (42.53%)
71-80	16 (18.39%)
81+	9 (10.34%)
Sex	
Male	46 (52.87%)
Female	41 (47.13%)
Marital status	
Single	1 (1.15%)
Married	57 (65.52%)
Divorced	3 (3.45%
Separated	0 (0.00%)
Widowed	26 (29.90%)
Literacy level	
Primary	21 (24.14%)
Secondary	5 (5.75%)
Tertiary	9 (10.34%)
Non-formal	52 (59.77)

Place of residence	
Rural dwellers	22 (25.29)
Urban dwellers	65 (74.71)
Living condition	
Living alone	1 (1.15)
Not living alone	86 (98.85)
Employment status	
Civil/public servants	4 (4.60%)
Farmers	9 (10.34%)
Petty traders	31 (35.63%)
[a]Skilled laborers	9 (10.34%)
[b]Unskilled laborers	17 (19.54%)
Retirees.	17 (19.54%)

[a]Skilled laborers include carpenters, seamstresses, builders, and drivers, [b]Unskilled laborers include housewives and janitors.

Table 2 shows the post-operative presenting visual acuity (PVA) and the best corrected visual acuity (BCVA) in comparison with the World Health Organization's guidelines. The PVA was good in 32 eyes (36.78%), borderline in 41 (47.13%) eyes, and poor in 14 (16.09%) eyes. Following refraction, the proportion of eyes with good outcomes increased to 86(78.16%) with only 7 (8.05%) remaining poor.

Table 2: Post-operative visual outcome of study participants in comparison with WHO guideline

Visual outcome category in LogMAR (Snellen's equivalence)	**PVA in % (WHO**)**	**PVA Frequency (%)**	**BCVA in % (WHO)**	**BCVA Frequency (%)**
Good ≥ 0.48 (6/18)	>80	32 (36.78)	>90	68 (78.16)
Borderline 0.48-1.0 (6/18-6/60)	<15	41 (47.13)	<5	12 (13.79)
Poor < 1.0 (6/60)	<5	14 (16.09)	<5	7 (8.05)
Total	**100**	**87 (100)**	**100**	**87 (100)**

PVA- Presenting Visual Acuity, WHO- World Health Organization, BCVA- Best-Corrected Visual

Using the LogMAR scale, the mean PVA was 0.6 (6/24) which improved to 0.3 (6/12) after refraction. The difference in PVA and BCVA was statistically significant by the Wilcoxon Sign Ranked test ($Z=7.7$, $P < .001$).

The geometric Mean total VF and QOL were both above 80% while the scores for the subscales were all greater than 70%.Two patients were not ambulant and three did not engage in social activities for reasons other than vision and so were excluded from the analysis in the respective subscales as presented inTable3.

Table 3: Mean postoperative visual function and quality of life scores of study participants in percentage

Patient-reported visual outcome		Number	Geometric Mean	95% confidence interval	
				Lower limit	Upper limit
VF[a] subscales	General VF	87	73.05	69.74	76.51
	Visual perception	87	94.15	91.11	97.28
	Peripheral vision	87	94.15	91.11	97.28
	Sensory adaptation	87	79.714	76.25	83.33
	Depth perception	87	99.57	98.89	100.25
	Total VF	87	87.11	85.27	89.00
QOL[b] subscales	Self-care	87	100.00	100.00	100.00
	Mobility	85	96.16	93.99	98.37
	Social interaction	84	97.32	94.79	99.92
	Mental wellbeing	87	97.89	95.90	99.92
	Total QOL	87	97.52	96.15	98.92

[a]*Visual function,* [b]*quality of life*

Figures 1 and 2 are scatter plots showing the relationship between PVA with VF and QOL scores in both the subscales and total.The QOL scores were generally higher than those of VF in all domains with self-care as the only subscale to score 100% for all participants.Spearman's correlation analysis of the relationship between PVA with VF and QOL in the total and subscales showed a negative correlation between PVA in LogMAR and mean total VF (r_s = -0.4, P < 0.001) and mean total QOL (r_s = -0.3, P = .01) which where statistically significant. Similar results were obtained for the relationship between PVA with VF and QOL across all subscales except depth perception where a statistically insignificant positive correlation was recorded. All patients scored 100% in the self-care domain hence, no correlational analysis was performed for that domain. Details are in Table 4.

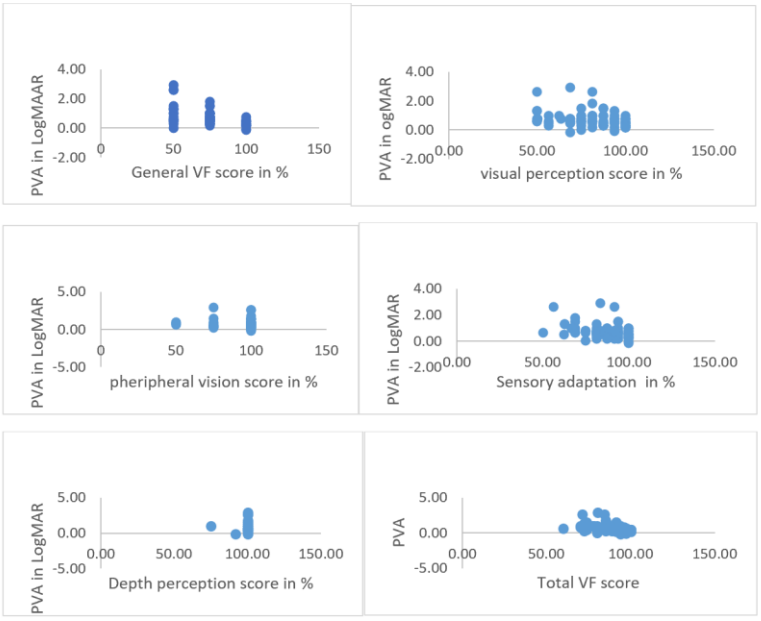

Figure 1:Scatter plot of Presenting visual acuity (PVA) and visual function (VF) scores by sub-scales/total

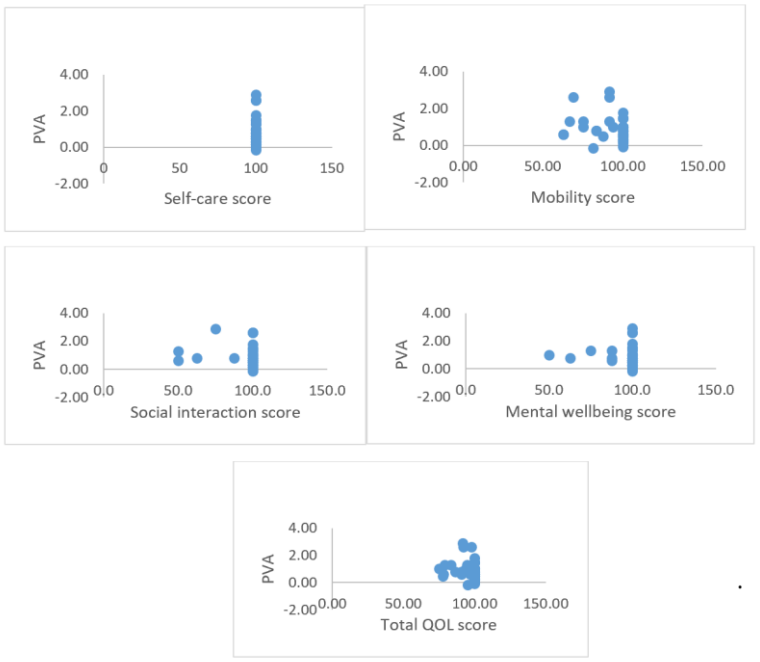

Figure 2: Scatter plot of Presenting visual acuity (PVA) and quality of life (QOL) scores by sub-scales/total

Table 4: Spearman's correlation of post-operative presenting visual acuity with visual function and quality of life

Patient-reported outcome		Spearman's correlation Coefficient (r_s)	*P* value
VF[a] sub-scale			
	General VF	-0.48	<.001[c]
	Visual perception	-0.32	.002[c]
	Peripheral vision	-0.02	.823
	Sensory adaptation	-0.33	.002[c]
	Depth perception	+0.04	.707
	Total VF	-0.43	< .001[c]
QOL[b] subscale			
	Self-care	-	-
	Mobility	-0.31	.004[c]
	Social interactions	-0.22	.041[c]
	Mental well being	-0.23	.031[c]
	Total QOL	-0.34	.011[c]

[a]*Visual function,* [b]*quality of life,* [c]*statistically significant*

3.2 Discussion

In this study, we found that the visual function (VF) and quality of life (QOL) scores were high and improved with increasing presenting visual acuity (PVA) among the patients who had undergone surgery for senile cataract.The meantotal postoperative VF score of 87.12% and mean total QOL score of 97.52% in this study is higher than the 58.3% and 47.5% reported for VF, 60.5% and 55.4% for QOL in the studies conducted by Odugbo[17]in Nigeria and Pokhrel[18] in India respectively.Several longitudinal studiesconducted in Nigeriausing similar patient-reported outcomestools as the current study reported huge improvements in VF and QOL scores following cataract surgery.[12,16,17,18]

Majority of the patients in this study scored high for VF/QOL despite having moderate visual outcome. The reason might be due to the fact that many of them were cataract blind pre-operatively and so are more likely to report large changes in VF/QOL with evenmoderate changes in vision following surgery. This is in contrast to patients in more developed settings who are usually operated for visually impairing cataracts, who would require a large improvement in vision postoperatively to report huge changes in VF/QOL.[17,19,20]For example, Odugbo[17]et al reported that changes in VF/QOL after cataract surgeryweremost remarkable among cataract blind patients with scores improvingfrom 12.5 and 22.4 pre-operatively to 58.3 and 60.5 post-surgery.[17]Another possible reason could be that the visual needs of our study population are likely to be low due to low literacy levels and less visually demanding occupations and lifestyles. Similarly, findings of the Pakistan blindness and visual impairment surveys revealed that among patients operated for cataract,rural dwelling and illiteracy were associated with lower VF/QOL in patients operated for cataract.[21]Hence, the a need to pay more attention to rural and illiterate populations.

This study found that the average total VF/QOL scores of participants were higher with decreasing PVA in the LogMAR scale. A similar trend was observed in the majority of the subscales.By subscale, depth perception, visual perception, and peripheral vision in the VF domain and mentalwell-being in the QOL domain had the highest scores. Some studies

havereported that general vision, visual perception, and sensory adaptationare the worst affected while peripheral vision and depth perception are the least affected domain in unoperated cataract patients.[16,21]In the QOL domain, Adamu[16] also documented that self-care was the worst affected while mental well-being was the least impacted pre-operatively with self-care showing the greatest improvement after cataract surgery. In contrast, Trans[19]reported that in Nigeria,social interaction and mobility were the worst affected with self-care being the least. Likewise, Taylor[21] reported that in Pakistan, mobility and mental well-being were the most affected with self-care as the least. The variations in these studies suggest level of improvement of VF/QOL by subscalesfollowing cataract surgerydiffers based on individual peculiarities such as literacy level, place of residence, family dynamicswith pre-operative visual acuity as the most important factor.[17]

Our study showed a negative correlation betweentotal VF/QOL in all subscales scores with PVA which was similar to the findings of the Nigerian blindness and visual impairment survey in which the correlational coefficientranged between -0.5 to -0.6 and -0.3 to -0.5for VF/QOL respectively.[19] They concluded that PVA was the most significant predictorof VF/QOL.The studies by Mosudi[12]and Adamu[16]documented a positive correlation between PVA and mean VF/QOL scores withcorrelational coefficients of 0.10 and 0.54for VF, 0.37 and 0.40for QOL respectively. Overall, all studies agreed that VF/QOL improved with improving vision after cataract surgery.[12,16,17,18,19]The observed variation is likely due to differences in the scoring and interpretation of VF/QOL scores between studies. Surveys that reported negative correlation interpreted increasing scores asan improvement in VF/QOL while those with positive correlation interpreted increasing scores as a decrease in VF/QOL.

Conventionally, patient-reported outcome results are focused on demonstrating changes in scores after an intervention. Similar single measurement of VF/QOL studies in Pakistan and Nigerian blindness and visual impairment surveys assessed single measurement of VF/QOL have provided useful evidence to show that conventional cataract surgery patients had better VF/QOL compared to unoperated cataracts patients or those who underwent traditional couching.[19,21]

4. CONCLUSION

Mean total VF and QOL and scores across all subscales in the study population were high and improved with increasing PVA. The use of patient reported outcome measures alongside clinical outcome evaluation provides a holistic assessment of the full benefits of cataract surgery.

CONSENT

All authors declare that written informed consent was obtained from all eligible participants for recruitment into the study and publication of the results of the study. Participation was fully voluntary and at all times, the tenets of the Declaration of Helsinki for research involving human subjects were upheld.

ETHICAL APPROVAL

Ethical approval for the study was obtained from the research ethics and review board of Bingham University Teaching Hospital and the Faith Alive Foundation Hospital Jos, North-Central, Nigeria.

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ABBREVIATIONS

CSC- cataract surgical coverage
CSR- Cataract surgical rate
BCVA- Best corrected visual acuity
LogMAR- logarithm of the minimal angle of resolution
LMICS- Low- and middle-income countries
PVA- Presenting visual acuity
WHO- World Health Organization
QOL- quality of life
RE- refractive error
VF-visual function