WORLD VIEW

Utility values among glaucoma patients: an impact on the quality of life

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Aim: To ascertain utility values and associated quality of life with different severity and duration of glaucoma among Indian patients.

Methods: Utility values of 105 consecutive patients with primary glaucoma of at least 12 months' duration were evaluated in a cross sectional study. Utility values were ascertained in five groups using both the time-trade off and standard gamble methods: group 1 (best corrected visual acuity in the better eye of 6/9 or better), group 2 (best corrected visual acuity in the better eye of 6/18 to 6/12), group 3 (best corrected visual acuity in the better eye of 6/36 to6/24), group 4 (best corrected visual acuity in the better eye of 3/60 to 6/60), and group 5 (best corrected visual acuity in the better eye of 3/60 or worse).

Results: The mean utility value for the glaucoma group as a whole was 0.64 (SD 0.69; 95% confidence interval (CI), 0.58 to 0.70) with the time-trade off method and 0.86 (SD 1.00; 95% CI, 0.81 to 0.90) with the standard gamble method for a gamble of death and 0.97 (SD 1.00; 95% CI, 0.94 to 0.99) for a gamble of blindness. The mean utility results by the time-trade off method were as follows: group 1 = 0.66, group 2 = 0.66, group 3 = 0.62, group 4 = 0.55, and group 5 = 0.61. The utility value was much lower (0.46) in those with no formal education or only primary education compared to those with postgraduate education (0.75) (p = 0.038). Those patients with glaucoma of less than 5 years' duration had a utility score of 0.62 while those with glaucoma for more than 10 years had a score of 0.74 (p = 0.40).

Conclusions: Visual acuity loss occurring secondary to glaucoma is associated with a substantial decrease in patient utility value (and quality of life) in a developing country like India. The utility value is directly dependent on the degree of visual acuity loss associated with the disease and educational status and not on the duration of disease, the number of medications, or the visual field indices.

Glaucoma is a disease that causes irreversible blindness with the blindness rate for primary angle closure glaucoma (PACG) being three to four times higher than for primary open angle glaucoma (POAG). One Indian study found a prevalence of 2.6% for any glaucoma, with 1.7% for POAG and 0.5% for PACG.[1] These values correspond with the prevalence of glaucoma in the West.

The value of health related quality of life measures and their application in medical research has been shown in various chronic and progressive diseases and also in certain life threatening diseases. Utility values are a measure of the subjective functional capacity of a patient; how a patient is troubled by his disease in his or her activities of everyday life. It is an indicator of the quality of life of the patient in relation to his disease. By convention, a utility value of 1.0 indicates a state of perfect health, whereas a utility value of 0 indicates death. A disease that affects the quality of life minimally such as systemic hypertension may have a utility score of 0.98[2] while severe angina may have a score of 0.50.[3] (table 1).

Using utility values to assess the quality of life and thereby health prioritisation of different diseases including glaucoma has been done among populations in developed nations; however, such an assessment has not been made among Indian patients with glaucoma. This study thus aimed to determine how much glaucoma affects the day to day life of our patients and what factors influence utility values.

PATIENTS AND METHODS

The study was carried out using a standard questionnaire for consecutive patients having chronic management for primary glaucoma seen in a tertiary care centre. The study was initiated after approval of the ethics committee. Interviews were conducted by a single examiner. The questions were translated according to the language understood by the patient.

Inclusion criteria were cases of established glaucoma following up for at least 12 months, who were able and willing to answer the questions in the questionnaire. Patients with any other condition that could impair vision, such as cataract, diabetes, and macular degeneration, were excluded from the study. Patients with a recent acute attack of angle closure were also excluded from the study. Patients who did not understand the questions or were not willing to answer them were excluded from the study.

All patients who had been diagnosed with glaucoma underwent a complete ophthalmic examination including a best corrected Snellen visual acuity, gonioscopy, standard achromatic automated perimetry, and Goldmann applanation tonometry. After the clinical examination, each patient was asked a series of questions according to the questionnaire.

In the time-trade off utility analysis the patients were asked the number of years of their presumed expected remaining years of life that they were willing to trade off for perfect vision. The time-trade off utility values were calculated by dividing the number of years traded by the number of expected remaining years of life and subtracting this proportion from 1.0 (table 2).

In the standard gamble method the patient was told to suppose that there was a technology that offered him perfect vision when the therapy was effective but when not effective the alternative was immediate death (gamble 1) or blindness (gamble 2). The patient was then asked how high a risk of

Abbreviations: PACG, primary angle closure glaucoma; POAG, primary open angle glaucoma

Table 1 Utility scores in various health states with regard to glaucoma

Disease/health state	Country	Sample size	Utility value	Study
1 Age related macular degeneration (mild)	USA	115	0.83	Stein[10]
2 Hypertension	USA	188	1.00	Stein[2]
3 Bilateral blindness	USA	15	0.26	Brown[11]
4 Oesophageal cancer	USA	50		Wildi SM[12]
Localised			0.80	
Metastatic			0.52	
5 Dry eye (severe)	USA	56	0.72	Schiffman[13]
6 Glaucoma	USA	237	0.91	Jampel[5]
	India	105	0.64	Present study

death (%) or blindness, if any, he or she would be willing to accept before refusing treatment that would restore perfect vision in each eye. This percentage was then subtracted from 1.0 to obtain the utility value.

Depending on the best corrected visual acuity in the better eye the patients were grouped as; group 1 (best corrected visual acuity in the better eye of 6/9 or better), group 2 (best corrected visual acuity in the better eye of 6/18 to 6/12), group 3 (best corrected visual acuity in the better eye of 6/36 to 6/24), group 4 (best corrected visual acuity in the better eye of 3/60 to 6/60), and group 5 (best corrected visual acuity in the better eye of 3/60 or worse).

Statistical analysis

The means, standard deviations (SD), and 95% confidence intervals (CI) were calculated for the utility values measured in the sample subgroups. The means of different sample subgroups were compared using the unpaired, two tailed Student's *t* test. Comparison of the means of time-trade off and standard gamble utilities within the visual stratification groups were performed using the paired, two tailed, Student's *t* test. Statistical significance was assumed to occur at the 0.05 level. Non-parametric tests, ANOVA, and Kruskal-Wallis tests were used keeping the utility score as the dependent variable.

RESULTS

The mean utility value for the glaucoma group as a whole was 0.64 (SD 0.69; 95% CI, 0.58 to 0.70) with the time-trade off method and 0.86 (SD 1.00; 95% CI, 0.81 to 0.90) with the standard gamble method for a gamble of death and 0.97(SD 1.00; 95% CI, 0.94 to 0.99) for a gamble of blindness. The mean utility results by the time-trade off method were as follows: 0.66 (SD 0.74), 0.66 (SD 0.69), 0.62 (SD 0.74), 0.55 (SD 0.67), and 0.61 (SD 0.60) for groups 1–5, respectively. The utility values by the standard gamble method for a gamble of death from groups 1–5, respectively were as follows: 0.83 (SD 0.9), 0.84 (SD 0.95), 0.90 (SD 1.00), 0.78 (SD 0.95), 0.92 (SD 1.00) The mean utility values for a gamble of blindness from groups 1–5, respectively, were 0.98, 0.99, 1.00, 0.84, and 0.94.

Table 2 Calculation of utility score

How to calculate a utility score: an example
Age of the respondent 50 years
Age the subject expects to live 70 years
Response to the time-trade off question above 10 years
Step 1: Determine the number of additional years the patient expects to live
70–50 = 20 additional years
Step 2: Divide the number of years the respondent is willing to give up to spend the rest of his/her living years free of glaucoma from the value obtained in step 1
10/20 = 0.50
Step 3: Subtract the value obtained in step 2 from 1.0
1.0–0.50 = 0.50
Interpretation: The respondent is willing to give up 50% of his/her remaining life years in a trade off for life without glaucoma. The utility value is calculated by subtracting the percentage of remaining years traded (0.50—ie, 50%) from the state of perfect health 1.0 (100%).

The utility value was much lower in those with no formal education or only primary education 0.46 (SD 0.50; CI, 0.27 to 0.50) compared to those with postgraduate education 0.75 (SD 0.75; CI, 0.66 to 0.84) (p value 0.038). Those patients with high school education were found to have a utility score of 0.69 (CI, 0.57 to 0.81) and those with graduate education were found to have a score of 0.62 (CI, 0.52 to 0.71). The duration of glaucoma did not make a significant difference in the utility scores. Those patients with glaucoma of less than 5 years' duration had a utility score of 0.62 (SD 0.67; CI, 0.54 to 0.70) while those with glaucoma for 5–10 years had a score of 0.69 (SD 0.50 CI, 0.42 to 0.75) and those with glaucoma for more than 10 years had a score of 0.74 (SD 0.55 CI, 0.4 to 0.65) (p = 0.40). Females were willing to trade off more years compared to males (p value = 0.04)

The average mean deviation on visual field of the right eye was −14.1 (SD 8.3) while in left eye it was −12.6 (8.3) dB The level of field loss in the better eye (mean deviation) did not affect the utility score (table 3). Similarly, the number of topical medications did not affect the utility score significantly. The history of previous glaucoma surgeries also did not affect the utility scores. While those who had undergone surgery had a score of 0.66 (SD 0.73; CI, 0.59 to 0.74), the patients who had no surgery had a score of 0.62 (SD 0.68 CI, 0.52–0.97) (p value 0.49). The utility values were not affected by the diagnostic groups of glaucoma or by the age of the patients. Patients aged less than 50 years had a utility value of 0.62 (SD 0.75; CI, 0.48 to 0.75) by the time-trade off method while those patients above 70 years had a utility value of 0.56 (SD 0.67; CI, 0.43 to 0.70) (p value 0.46).

Regression analysis of the variables was done keeping the utility score as the dependent variable (table 4). Variables like age (p value 0.717), visual acuity (p value 0.382), mean deviation (p value 0.317), number of medications (p value 0.164), and duration of the disease (p value 0.60) did not seem to have a significant influence on the utility value. However, the level of education had a significant effect on the utility values (p value 0.004).

In all groups of patients and in all the parameters assessed, the utility scores by the gamble method were significantly higher than with the time-trade off method (table 4).

DISCUSSION

The utility theory was propounded by Von Neumann and Morgernstern to quantify the uncertainty that existed in various fields of assessing quality of life measures.[4] It is an

Table 3 Utility scores in different groups

Variable	Participants	Utility score		
		Time-trade off	Gamble 1	Gamble 2
Total	105	0.64	0.86	0.97
Sex				
Male	81	0.69	0.86	0.96
Female	24	0.48	0.84	1.00
Age				
<50	21	0.62	0.86	0.97
51–60	19	0.69	0.87	1.00
61–70	38	0.69	0.87	0.96
>70	27	0.56	0.83	0.95
Number of medications				
1	69	0.63	0.84	0.96
2	30	0.66	0.88	0.97
3	6	0.74	0.90	1.00
Glaucoma surgery				
Yes	44	0.62	0.87	0.96
No	61	0.66	0.83	0.95
Diagnosis				
POAG	52	0.66	0.99	1.00
PACG	38	0.60	0.85	0.98
JOAG	08	0.70	0.82	0.95
LTG	07	0.64	0.95	0.91
Mean deviation				
<10	25	0.68	0.84	0.97
10–15	16	0.63	0.81	0.98
>15	62	0.64	0.88	0.97

objective evaluation of the patients' quality of life, which gives an indication as to how much the patient perceives the disease state affects his day to day living—namely his quality of life.

There are various factors that might be expected to affect the impact of a disease state on the quality of life of a patient, such as duration of the disease, the educational qualification, the patient's age, sex, the socioeconomic condition, whether the disease is acute or chronic, and psychological variations among individuals. This could cause the values to be different for the same disease depending on the population studied. To the best of our knowledge there has not been any study that has reported the utility values in glaucoma among Indian patients. Other studies[5 6] have assessed utility values among glaucoma patients and have found higher values; these have primarily been done in patients from developed countries where the understanding of the disease among patients is better and there is a better social and medical support system.

Ophthalmic utility values appear to have good test-retest reliability over prolonged periods of time.[6] Among ocular conditions that cause loss of vision it has been reported that the utility values correlate with the amount of visual loss and not the cause of visual loss. While Torrance and Feeny[3] reported a utility value of 0.39 for blindness their study did not define blindness. Whether the visual loss is caused by age related macular degeneration or cataract or diabetic retinopathy it was not shown to alter the utility value.[7]

Table 4 Multiple regression analysis of factors affecting utility score

Multiple linear regression analysis	p Value
Visual acuity in the better eye	0.382
Age	0.717
Sex	0.769
Visual field (mean deviation)	0.317
Number of glaucoma medications	0.164
Years since diagnosis of glaucoma was made	0.60
Number of glaucoma surgeries	0.769
Educational status	0.004
Income	0.342
Associated systemic diseases	0.935

In the present study population, the mean utility value for the total group with glaucoma was 0.64 using the time-trade off method. This value is much lower than previously reported from studies of glaucoma patients in developed countries. Jampel *et al*[5] have reported utility values of 0.91 in glaucoma patients by the time-trade off method. Most of their patients had early glaucoma or were glaucoma suspects while most of our patients had moderate to advanced glaucoma in at least one eye. Another reason for this difference may be the varying impact of this disease on the patients in developing countries with a poorer socioeconomic status, economic burden of lifelong therapy, and lack of social support compared to the impact in developed nations.

In our study females were willing to trade off more years compared to males, which could be because of the lesser understanding of the disease among women and the fact that they have greater dependency on other family members in decision making. It was also found that those patients who were more than 70 years of age were willing to trade off a greater proportion of their remaining years than those less than 70 years, though the value was not statistically significant ($p = 0.46$).

The level of education also made a difference to the utility values. Those patients with no formal education or primary education were found to trade off significantly more years than those with postgraduate education ($p = 0.038$). This may be explained by the fact that the knowledge about the disease and the compliance of an educated person to his medication may be better. Also his understanding may be aided by the reasoning that the disease does respond favourably to medical or surgical management.

As expected, the patients with POAG and PACG did not show a significant difference in the utility values, indicating that the patient is primarily concerned with his visual handicap and not the diagnosis.

We also assessed the impact of the duration of the disease on the utility score. The duration of the glaucoma, less than 5 years or more than 10 years, did not significantly change

the utility values, though it was seen that the patients with the disease for a period less than 5 years had a utility value of 0.62 compared to patients with the disease for more than 10 years who had a higher utility value of 0.74 ($p = 0.4$). This may be an indicator of the increased ability of the patient to cope with his disease and better understanding of the disease with time.

The mean deviation was not found to affect the utility value, again corroborating the fact that it is mainly the visual acuity that is of concern to the patient and not the status of his visual field.

Those who had not undergone surgery for glaucoma had marginally better utility values than those patients who had undergone surgery ($p = 0.49$). The number of antiglaucoma medications used by the patient, surprisingly, did not make a significant difference in the utility value.

We also tried to assess the impact of an associated systemic disease on the utility score. Our patients had associated systemic hypertension, diabetes mellitus, ischaemic heart disease, bronchial asthma, and other diseases. But the presence of an associated systemic disease did not significantly affect the utility score. The income of the patients also surprisingly did not affect the utility score significantly.

In the present study, the utility values were significantly higher with a gamble of death or blindness (0.86 and 0.97 respectively). Though the gold standard for assessment of utility values is said to be the gamble method, Wakker *et al* and Richardson *et al* have questioned its validity.[8 9] The standard gamble method has been shown to overestimate risk aversion compared with other methods.[8] They also state that since the main purpose of such studies is to compare the different disease states and their influence on the quality of life, the time-trade off method offers a better standardisation for comparison.

Hence, it is apparent from this study that the utility values (quality of life) among our glaucoma patients are lower than those reported from developed countries. Lower socioeconomic states and lower literacy levels are attributed to lack of knowledge about the disease and thereby greater concern for it. The economic burden of lifelong therapy is an important determinant of the quality of life in developing nations.

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