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Research Paper

Patients' adherence to topical antiglaucoma medications in a tertiary care hospital

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Abstract

Objectives Adherence to glaucoma medications is a central factor to control intraocular pressure and manage glaucoma effectively. This study aims to assess the level of adherence of glaucoma patients to ocular hypotensive agents and determine factors contributing to non-adherence in the Aseer region.

Methods This was a single-centre, prospective cross-sectional study carried out in Aseer Hospital, Saudi Arabia. Data were collected through a customized questionnaire adapted from the Morisky, Green and Levine Medication Adherence Questionnaire (MGLS).

Key findings Of the 102 glaucoma patients, 63 (61.8%) were non-adherent to their glaucoma medications. About 48 (76.2%) of them reported that they have no background information about glaucoma. Older participants (37, 58.7%; >50 years) showed a low adherence level compared with the younger individuals. Contributing factors to non-adherence include forgetting the dose time (32, 50.8%), illiteracy (31, 49.2%; $P = 0.313$), economic problems (26, 41.3%; $P = 0.286$) and lack of information about prescribed medications (15, 23.8%; $P = 0.188$).

Conclusions No significant relationship was found between medication adherence and patient's demographic data or their background knowledge about glaucoma. Despite the need for improving the glaucoma patient's knowledge of their disease and the importance of medication adherence, an additional strategy as alerts by smartwatches should be encouraged to improve the adherence level.

Keywords: glaucoma; adherence; ocular hypotensive agents

Introduction

The prevalence of glaucoma has been estimated at 70 million people worldwide. It is rated as the second cause of blindness, and it can affect all age groups.[1] Both types of glaucomas – open angle and close angle – are optic neuropathies affecting the ganglion cells in the eyes, which leads to ganglionic cell death that increases intraocular pressure (IOP).[2] The increase in IOP is the main modifiable risk factor for glaucoma,[3] thereby the pharmacotherapy for glaucoma depends on medications that reduce IOP, thus slowing the progression of the disease.[4]

Glaucoma management generally depends on controlling IOP by topical hypotensive medications. The available medications include prostaglandins analogues, carbonic anhydrase inhibitors, beta-receptor antagonists, alpha-adrenergic agonists and cholinergic

agonists.[4] Long-term adherence to topical hypotensive medications is the cornerstone of successful control of the IOP and further prevention of glaucoma.

This questionnaire-based study showed a high rate of non-adherence and suboptimal adherence to topical hypotensive medications, which is the main problem facing glaucoma management.[5–7] Many factors are related to non-adherence, with the dry eye being a major factor in decreasing patient adherence, in addition to low monthly income.[6, 8, 9] Increased daily frequency of eye drops will also lower the adherence level. Minimal knowledge about glaucoma and the benefits of the eye drops is seen as a non-acceptance of the disease. Patients' ideas that there are no immediate complications from the disease, in addition to their low education level, may also contribute to omitting the prescribed eye drops.[5, 6, 10] Studies also found that younger patients demonstrate less adherence than older patients.[5, 6, 10] Furthermore, patients who purchased eye drops by themselves were more likely to be non-adherent to their medications.[6] Understanding the reasons for non-adherence will help in determining the appropriate corrective actions to support patients in adherence to their glaucoma medications.

The aim of our study was to measure the level of adherence of glaucoma patients by using a validated questionnaire. Furthermore, this would highlight the reasons for non-adherence in this specific region of Saudi Arabia.

Patients and Methods

This was designed as a single-centre, prospective cross-sectional study. The study was carried out in Aseer Hospital, Saudi Arabia. Ethical committee approval and written informed consent from the patients or caregivers were obtained before the start of the study.

Patients eligible for enrolment at baseline were male or female aged older than 30 years. Potential participants had been previously diagnosed with glaucoma and their IOP was more than 20 mmHg. Additionally, patients who had been receiving treatment via eye drops for at least 1 month and not more than 2 years were included. Participants were excluded if they were younger than 30 years or older than 85 years, their IOP was less than 20 mmHg and they had serious or unstable medical conditions. Other exclusions were patients whose physicians felt they should be excluded from the data collection process for any other reasons. The estimated minimum sample size was 86, which was calculated using the Raosoft sample size calculator, with a confidence interval of 95%, a limit of 5% precision and a design effect of 1%.

Patients were invited to participate during a visit to the outpatient ophthalmology clinic at Aseer Hospital. Once they signed the consent form, the interview began.

Measures

To investigate medication adherence, a customized questionnaire was developed, which included questions adapted from the Morisky, Green and Levine Medications Adherence Questionnaire (MGLS). This includes four questions with yes/no response options and a questionnaire designed specifically for glaucoma patients. The adherence scores on the four-item MGL were calculated as MGL <2 representing low adherence and MGL >2 representing high adherence.[11] Other questions assessed the patient's knowledge and beliefs about glaucoma, as well as factors contributing to non-adherence. Self-reported reasons for medication non-adherence (including seven potential reasons) were asked. The questionnaire was translated into Arabic, the national language, and then translated back into English.

Data were expressed as mean ± SD for continuous variables and *n* (%) for categorical variables. For categorical variables, we used the chi-square test for the calculation of *P*, which is statistically significant when less than 0.05. The assessment of factors that affect the patients' adherence was carried out by multivariate binary logistic regression analysis and estimated odds ratios, 95% confidence intervals and *P* values. The association was declared statistically significant at $P < 0.05$. Data were analysed using SPSS (version 25).

Results

Basic demographics and clinical characteristics

Of the total 102 patients, a higher number of females (61, 59.8%) were studied, compared with males (41, 40.2%). The majority of patients were in the age group older than 50 years (59, 57.8%), followed by the age group 40–50 years (22, 21.6%). Fifty-six (54.9%) participants were educated, while 46 (45.1%) were illiterate. However, illiteracy was a statistically insignificant factor when related to adherence ($P = 0.543$). Thirty-five (34.3%) patients had a family history of glaucoma, while 59 patients had unilateral glaucoma and 43 had bilateral glaucoma. Of the total, 67.4% of the patients were non-adherent to their glaucoma medication routine (Table 1).

Prevalence of non-adherence

The overall prevalence of therapeutic non-adherence, meaning a score >2 on the four-item Morisky adherence scale, was 61.8% (63

Table 1 Baseline demographics and clinical characteristics of participants

	Frequency (*n*)	Percent (%)
Age (years)		
30–40	21	20.6
40–50	22	21.6
Older than 50	59	57.8
Gender		
Male	41	40.2
Female	61	59.8
Authenticity		
Black	12	11.8
White	90	88.2
Eye suffers from high intraocular pressure		
Right	35	34.3
Left	24	23.5
Both	43	42.2
Disease status		
Other vision problems		
Yes	55	53.9
No	47	46.1
Diabetic		
Yes	40	39.2
No	62	60.8
Hypertension		
Yes	43	42.2
No	59	57.8
Other diseases		
Yes	19	18.6
No	83	81.4
Family history of glaucoma		
Yes	35	34.3
No	67	65.7

patients). The reasons patients cited for non-adherence are included in Table 2.

Demographics and adherence

The socio-demographic and clinical characteristics of the study participants are summarized in Table 3. Female participants reported a higher level of non-adherence (39, 38.2%) than the male participants (24, 23.5%). Older participants (37, 58.7%) were more likely to demonstrate low adherence compared with the younger individuals. Thirty-one (49.2%) of the non-adherent participants were illiterate. However, none of the parameters reached statistical significance using the chi-square test ($P > 0.05$).

Table 2 Reasons for patients' non-adherence

Reason	Frequency of response, *n* (%)
Forgetfulness	32 (50.8)
Not one of the patient's priority	9 (14.3)
Age	7 (12.5)
Travelling	5 (7.9)
Poor patient knowledge	4 (6.3)
Afraid of getting blindness	3 (4.8)
Depending on others for eye drops administration	2 (1.8)

Table 3 Demographics compared with the adherence level using the MGL Medication Adherence Questionnaire

Demographics		Adherent	Non-adherent	Chi-square (χ^2), *P* value
Sex	Male (*n* = 41)	17 (41.4%)	24 (58.5%)	$\chi^2 = 0.58$,
	Female (*n* = 61)	22 (36%)	39 (64%)	$P = 0.67$
Age (years)	30–40	9 (23%)	12 (19)	$\chi^2 = 0.245$,
	40–50	8 (20.5%)	14 (22.3)	$P = 0.885$
	>50	22 (56.4)	37 (58.7)	
Authenticity	Black	4 (10.3)	8 (12.6)	$\chi^2 = 0.71$,
	White	35 (89.7)	55 (87.4)	$P = 0.486$
Educational level	Illiterate	15 (38.4)	31 (49.2)	$\chi^2 = 1.123$,
	Educated	24 (61.6)	32 (50.8)	$P = 0.313$
The affected eye	Right	14 (35.9%)	21 (33.3%)	$\chi^2 = 1.22$,
	Left	11 (28.2%)	13 (20.6%)	$P = 0.543$
	Both	14 (35.9%)	29 (46%)	

Knowledge of disease and patient perception

Forty-eight (76.2%) of the non-adherent participants agreed that they received no background information about glaucoma. However, 54 (85.7%) said that they received information about the disease and the medications from their physicians and 42 (66.7%) of the non-adherent participants agreed that the pharmacist gave them sufficient information about the correct procedure for applying the eye drops.

Treatment of glaucoma

Of those who adhered to their treatment plan, 66.7% indicated that they applied the eye drops correctly. Of the 63 participants who were non-adherent, 18 reported an increase in the non-adherence level when the dose frequency was increased. Of the 102 patients who completed the interview, just 38 indicated that the cost of the drug affected their adherence level. Regarding eye drop-related side effects such as burning, itching and redness, 28.6% of non-adherent patients were having these effects, while 30.8% of adherent patients reported side effects from the medication. However, medication side effects played no statistically significant role in adherence ($P = 0.813$).

Factors contributing to non-adherence

Among the non-adherent patients ($n = 63$), illiteracy was found in 31 (49.2%, $P = 0.313$) patients, cost was prohibitive for 26 (41.3%, $P = 0.286$) patients and lack of information about the prescribed medications was noted in 15 (23.8%, $P = 0.188$) patients. Forgetting the dose time was chosen by 32 (50.8%) patients and low priority of the drugs was reported by 9 (14.3%) of the non-adherent patients. Advanced age affected the adherence level of only seven patients (12.5%), while travelling was the reason for non-adherence reported by five (7.9%) patients. Only two (1.8%) patients noted that they depended on others to receive their eye drops and only three (4.8%) were afraid of becoming blind. The details are given in Tables 4 and 5. It is clear that the major factors for non-adherence are illiteracy,

Table 4 Multivariate logistic regression analysis of factors evaluated for association with non-adherence to antiglaucoma treatment

Model		Unstandardized coefficients		Standardized coefficients	*t*	Sig.
		B	Std. error	Beta		
1	(Constant)	2.293	0.682		3.363	0.001
	Age	−0.100	0.085	−0.166	−1.178	0.242
	Gender	−0.039	0.106	−0.039	−0.367	0.715
	Authenticity	0.045	0.160	0.030	0.278	0.782
	Educational level	−0.146	0.132	−0.150	−1.109	0.271
	Family history	−0.070	0.104	−0.068	−0.671	0.504
	Background information about glaucoma	0.126	0.113	0.117	1.111	0.270
	Diabetes	−0.090	0.128	−0.091	−0.706	0.482
	Other vision problems	−0.009	0.102	−0.010	−0.092	0.927
	Side effects of drugs	0.081	0.115	0.076	0.706	0.482
	Increasing dose frequency	−0.433	0.144	−0.354	−3.006	0.003*
	Medication cost	−0.004	0.109	−0.004	−0.039	0.969
	Information from physicians	−0.109	0.149	−0.083	−0.732	0.466
	Information to the patient about his eye drops	0.168	0.121	0.156	1.395	0.167
	Use of eye drops correctly	0.189	0.118	0.177	1.596	0.114
	Hypertension	−0.089	0.125	−0.091	−0.713	0.478
	Other disease states	0.155	0.140	0.125	1.107	0.271

Dependent variable: Level of adherence. *P-values < 0.05.

the prohibitive cost of medication, lack of information about the prescribed medications and lack of awareness of the importance of regular treatment.

Discussion

This study was designed to estimate the adherence level of patients with glaucoma to their ocular hypotensive medications. The current study found that 63 (61.8%) of the 102 participants were non-adherent to their medications. These results were in accordance with the results presented in several other countries, which also indicated high levels of non-adherence, such as 72.1% in Canada,[12] 72.7% in the Netherlands[13] and 56% in Greece.[14] The study by Abu Hussein *et al.*[15] also found a high percentage of non-compliance to glaucoma medication (53.6%). However, the adherence level was high in the study by Mehari *et al.*[6], who reported that 153 (42.6%) patients were found to be taking their medications as prescribed. Similarities are apparent between the attitudes expressed by Mehari *et al.*[6] and those described by Okeke *et al.*[1] This may be due to the fact that patients included in the two studies were receiving only one drop per day. Another study by Sleath *et al.* [16] (2011) indicated that 40–45% of their participants were adherent to their treatment. The wide variation of adherence level among the studies might be due to the inconsistency of the definition of non-adherence, differences in the education levels of patients, as well as the different cultures with different habits and the variations among patient groups.

In this study, the socio-demographic characteristics of the patients were not significantly associated with the adherence level when using the multivariate logistic regression analysis. This finding is supported by many previous studies.[6, 17, 18]

Regarding factors related to non-adherence, the factor 'forgetfulness' recorded the highest frequency among the non-adherent patients. This finding was in line with numerous other studies.[19–21] The patient's knowledge about glaucoma and the importance of adherence to their medications were associated with a high level of non-adherence, as 76.8% of the non-adherent patients complained that they lacked background information about their disease and the importance of adherence to their treatment. However, many previous studies indicated no significant association was found between the level of adherence and the background information.[5, 17, 22, 23] The differences between the studies may be due to differences in the definition of background information, as well as the broad nature of the questions which assessed this domain. Hoevenaars *et al.*[24] studied only the association between background information and level of non-adherence; they concluded that no clear correlation was demonstrated between patients' knowledge of glaucoma and their adherence behaviour.

By using multivariate analysis, we found a significant correlation between the number of daily drops used and the level of adherence; as the number of daily drops increased, the level of adherence decreased ($P = 0.04$). We are in accordance with many previous studies which reported that typically an increased frequency of daily dose is associated with increased non-adherence.[21, 25]

Side effects also pose barriers to glaucoma medication adherence[21] and may be related to discontinuation of the therapy altogether.[26] However, in this study, two-thirds of the non-adherent patients reported that they did not stop the medications because of the side effects ($P = 0.482$). Our results were in contrast to the study by Abu Hussein *et al*, which indicated that 60.6% of non-compliant patients reported side effects to the medication.[5, 15] However, Abu Hussein *et al.* noted that during the univariate and multivariate analysis, the medication's side effects showed no significant association with patient compliance.

Table 5 Patients' beliefs about glaucoma medications

Question	Adherent	Non-adherent	*P* value
1. Hypertensive patient			
Yes	13 (33.3)	30 (47.6)	0.156
No	26 (66.7)	33 (52.4)	
2. Correct steps to apply eye drops			
Yes	30 (76.9)	42 (66.7)	0.269
No	9 (23.1)	21 (33.3)	
3. Other vision problems			
Yes	18 (46.2)	37 (58.7)	0.216
No	21 (53.8)	26 (41.3)	
4. Medication side effects			
Yes	12 (30.8)	18 (28.6)	0.813
No	27 (69.2)	45 (71.4)	
5. Patients have background information about glaucoma			
Yes	14 (35.9)	15 (23.8)	0.188
No	25 (64.1)	48 (76.2)	
6. Increasing dose frequency will decrease patient's adherence			
Yes	2 (5.1)	18 (28.6)	0.004
No	37 (94.9)	45 (71.4)	
7. Enough information given to the patient about his disease and medications by the physician			
Yes	31 (79.5)	54 (85.7)	0.412
No	8 (20.5)	9 (14.3)	
8. Enough information given to the patient about his eye drops by the pharmacist			
Yes	31 (79.5)	42 (66.7)	0.163
No	8 (20.5)	21 (33.3)	
9. Family history of glaucoma			
Yes	13 (37.1)	22 (62.9)	0.87
No	26 (38.8)	41 (61.2)	
10. Other disease			
Yes	8 (20.5)	11 (17.5)	0.7
No	31 (79.5)	52 (82.5)	
11. Diabetic patient			
Yes	14 (35.9)	26 (41.3)	0.589
No	25 (64.1)	37 (58.7)	
12. The disease affects the patient's daily activities			
Yes	22 (56.4)	41 (65.1)	0.381
No	17 (43.6)	22 (34.9)	
13. Medication cost affects adherence			
Yes	12 (30.8)	26 (41.3)	0.286
No	27 (69.2)	37 (58.7)	

In this study, we noted a high prevalence of non-adherence among the elderly patients; however, it was statistically non-significant ($P = 0.885$). This may be attributed to lack of supportive family members, problems with memory, low manual dexterity in the application of the eye drops or the presence of another disease and co-morbidities. Our results are in accordance with many previous studies which also indicated a high level of non-adherence among elderly patients.[15] Many different reasons were identified by the various studies. Three studies reported a low level of adherence due to difficulty in reading prescription labels, while others reported comprehension and memory as issues.[27, 28] Manual dexterity and coordination were mentioned in the studies of Flowers *et al.* and Kahook [29] , as well as that of Taylor *et al.*[27–30] However, Tse *et al.*[20] concluded that glaucoma treatment adherence improves with increasing age, with younger patients tending to have the worst adherence of all age groups.

The prohibitive cost of buying glaucoma medications has also been reported as a major factor contributing to non-adherence. This finding is in line with the study of Abu Hussein *et al*.[15] who showed a statistically significant higher compliance rate among patients with insurance coverage. Another study given by Eldaly *et al*.[25] illustrated that the economic burden of glaucoma medications in Egypt is a major cause of uncontrolled IOP. In addition, in many previous studies, this factor has been cited as a major cause of non-adherence.[21, 27, 28]

In conclusion, we did not find any significant association between the socio-demographic characteristics of our patients or their knowledge about glaucoma and medication adherence with their general level of adherence. However, it is necessary to unify the definition of 'knowledge' due to the large variation among studies. Also, it is very important to increase the knowledge that glaucoma patients receive about the importance of adherence to their ocular hypotensive agents, as a high percentage of our patients were non-adherent to their treatments. New smartwatches which can be connected to health applications may be useful for glaucoma patients in improving their adherence level, as it alerts patients to treatment times through sounds and vibrations.

Limitations of the study

The major limitations of this study are the single site used for recruitment and the small sample size. A larger, multicentre sample may have produced more definitive findings, but data saturation that occurred at this single-site study gives credence to these findings.

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Conflict of Interest

The authors declared no conflict of interest.

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