Impact of pharmacist-led interventions in improving adherence to glaucoma medications in the geriatric population

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Abstract

Objectives: Geriatric patients can be non-adherent to ophthalmic glaucoma medications because of complex eye drops instillation techniques and forgetfulness, so pharmacists can play their part in improving the clinical outcomes of patients by acting as care providers. The purpose of the current study was to implement various pharmacist-led interventions to improve adherence to glaucoma medications and to evaluate the outcomes of interventions in the geriatric population.

Methods: The Morisky Green Levine (MGL) adherence scale was used for analysis because it measures the extent of non-adherence and analyses the reasons for it. The interview-based sessions were conducted with control and interventional groups followed by educational interventions, including techniques for eye drop instillation, graphical images, precautionary measures, and individual patient counselling for the interventional group. Patients were asked to complete the adherence scale after the conclusion of every follow-up session for a duration of 6 months.

Results: After 6 months of pharmacist-led interventions, a significant shift was found in the interventional group from low to high adherence according to MGL scale evaluation. Moreover, the number of patients in the interventional group whose intraocular pressure was in the safe range significantly increased and follow-up sessions significantly improved the patient's knowledge about glaucoma.

Conclusion: The results of this pharmacist-led educational interventional study showed it was effective in improving adherence to glaucoma medications in the geriatric patients, who showed better adherence scores and improved intraocular pressure.

Republished from: *Eur J Hosp Pharm* 2021;28:e191–e196. doi:10.1136/ejhpharm-2021-002788 **S Afr Pharm J 2024;91(1):12-18**

Introduction

Glaucoma is the second leading cause of blindness worldwide and is associated with optic nerve damage. The condition is asymptomatic in the earlier stages, consequently leading to irreversible vision loss.[1] Increased intraocular pressure (IOP) is the marker of disease progression in primary open angle glaucoma (POAG) and angle closure glaucoma.[2] In normal tension glaucoma, the IOP lies in the physiological range of 12–22 mmHg, but the disease still prevails.[3] Ageing is among several risk factors for aggravation of glaucoma in geriatric patients because of comorbidities, forgetfulness, poor medication-taking behaviour, and non-adherence.[4]

Ophthalmic drops for the conventional treatment of glaucoma include a combination therapy of β blockers, prostaglandin analogues, cholinergic agonists, and α agonists.[5] Geriatric patients have been found to be non-adherent to ophthalmic glaucoma medications because of a complex eye drops instillation technique and forgetfulness.[6] Patients should be verbally and practically guided about the instillation method of eye drops.[7] Patients often find it difficult to direct the ophthalmic dispensing bottle into their eyes properly, which leads to under-dosing.[8] Different studies have been conducted to highlight this issue. For instance, a study was designed to evaluate the effects of physician-led educational interventions on patients with glaucoma who were potentially non-adherent. The results depicted a non-significant difference in patient medication adherence, suggesting that team collaboration could show improved outcomes.[9] Another group-based educational intervention study was conducted in patients with glaucoma by using questionnaires, relevant videos, and brochures. The outcomes were favourable, including self-reported adherence, beliefs about medication, knowledge of glaucoma, and maintenance of adherence.[10] Older populations are found to be more compliant towards medication regimes after receiving standard education, a medication schedule, and verbal communication.[11] Interactive education sessions for patients with glaucoma have been found to be beneficial for medication compliance.[12] There are several factors affecting glaucoma treatment adherence, including lack of communication between patient and care provider.[13] Moreover, another study concluded that the IOP in patients with glaucoma could be managed by improving the patient–provider communication approach and

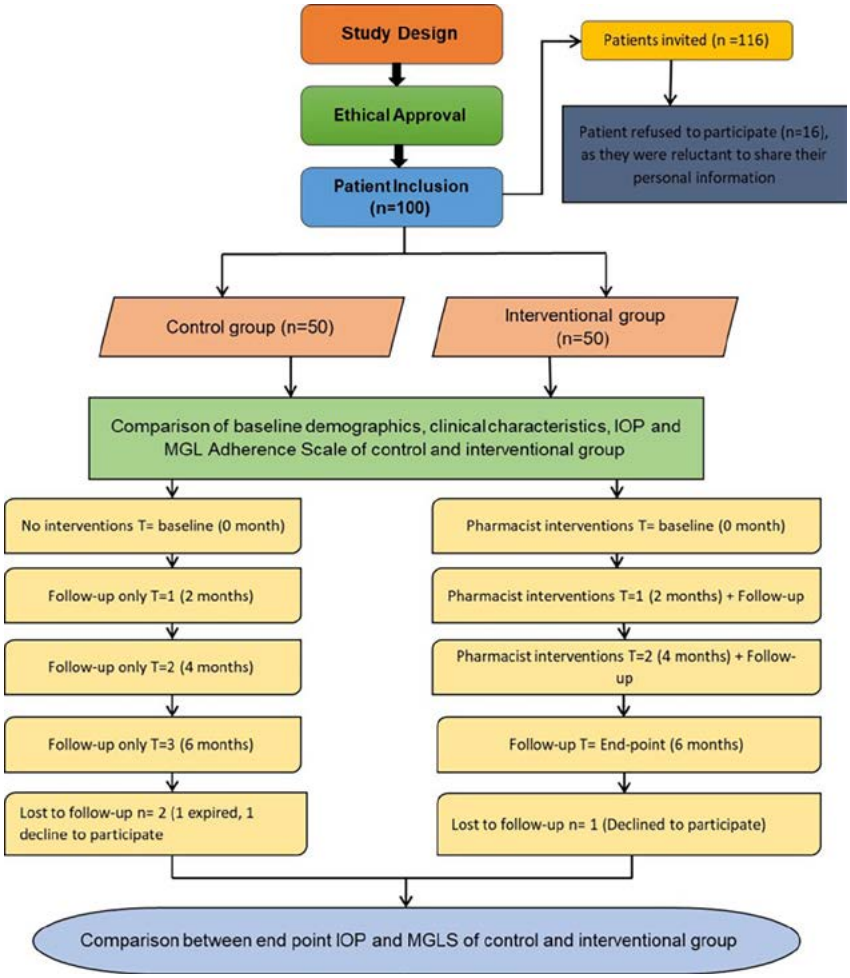

Figure 1: A comprehensive study design showing recruitment and comparison of control and interventional groups. MGLS, Morisky Green Levine adherence scale.

patient input.[14] This evidence suggests that pharmacists can play the part of care provider by using therapeutic management, thus improving the clinical outcomes of patients.[15]

The objective of this cross-sectional prospective study was to implement various pharmacist-led interventions on geriatric patients with glaucoma and to evaluate the outcomes of these interventions. Some previous studies suggest that pharmacists should play the part of care provider to patients with glaucoma, helping them to maintain their IOP within the safe range.[9] The effects of previous studies on medication adherence did not seem to last for a long time. This could be due to lack of sufficient follow-up sessions with patients, which suggests that repeated interactions and more follow-up are required to achieve prolonged benefits. Therefore, this study focuses on three consecutive counselling sessions with geriatric patients with glaucoma every 2 months for a duration of 6 months.

In this study, we used the Morisky Green Levine (MGL) adherence scale. This scale was chosen as it not only measures the extent of non-adherence but also analyses the reasons for it. The interview-based sessions were conducted with control and interventional groups at baseline to collect relevant demographic and medical data. Later, educational interventions were given to the interventional group, including guidance on the technique for eye drops instillation, providing glaucoma-related brochures, graphical images, precautionary measures, lifestyle modification advice, and individual patient counselling. Patients were asked to complete the adherence scale after the conclusion of every follow-up session for a period of 6 months, and the data were statistically evaluated through application of SPSS software.

Materials and methods

Study design

A cross-sectional interventional study was conducted at the Department of Ophthalmology, Services Institute of Medical Sciences (SIMS), a public sector hospital in Lahore, Pakistan. The study was approved by the Institutional Review Board of SIMS under reference number IRB/2019/532/SIMS. Informed written consent was obtained from all the participants in the control and interventional groups in their native language, and the study objective was thoroughly explained. Before the start of the study, participants were informed of the study's objective and health benefits. All the participants agreed to use the collected data for scientific research purposes only. A comprehensive study design is shown in the Figure 1.

Patient recruitment

Geriatric patients with glaucoma who were aged 60 and older and had been prescribed one or more glaucoma medications were recruited while attending the Ophthalmology Department of SIMS as outpatients from 25 April to 20 May 2019. Patients who were completely blind due to glaucoma were excluded as they would affect the study outcomes. Quantitative measurement on the adherence scale and follow-ups were continued from May 2019 to October 2019 in three follow-up sessions. A tonometry test was performed for this purpose. This test is a diagnostic tool to measure the pressure inside your eye (IOP). This measurement helps doctors to determine whether or not there is a risk of glaucoma. The test was performed by two trained technicians in the presence of a supervisor who had completed a Bachelor of Science in Optometry. The average number of tests performed per day by a single technician was 10. The study was conducted in a public sector hospital in Lahore, Pakistan, which is usually operational during the day between 08:00 and 14:00. Therefore, tonometry was performed during laboratory hours from 09:00 to 13:00. The technicians who performed the test were masked to randomisation because they were kept blinded about the

study being conducted. They tested the study participants in the same way they tested other patients. One hundred patients were recruited for the study; fifty were randomly assigned to the control group and 50 to the interventional group using a block randomisation technique.

Interventions

Study subjects attended the Ophthalmology Department of SIMS for routine monthly visits and free medication. Patients' baseline demographics, clinical characteristics, medical and medication history were collected from their hospital medical files. Patients in the control group (n = 50) were observed by the researcher while they followed their usual care. Patients in the interventional group were provided with pharmacist-led interventions in addition to routine medical care at baseline (T = 0), and after the second (T = 1), fourth (T = 2), and sixth (T = 3) month. Interventions included a dose calendar as a reminder of patients' routine drug regimen and brochures about glaucoma in their native language, including precautionary measures, instructions, and lifestyle modifications. The standard interventions of the Glaucoma Research Foundation are provided in online supplemental data. Patients were also shown the technique for instillation of eye drops as recommended by the Glaucoma Research Foundation, San Francisco, CA.

Study outcomes

The primary study outcome was adherence to medications, evaluated after permission by using the MGL adherence scale, which consisted of four questions.

Among the different adherence scales, the most widespread is the MGL adherence scale. This scale was originally designed as a four-item scale with yes or no responses; however, since 2008 an eight-item version is also available. Irrespective of the scale type, the results are usually interpreted in the same way (the lowest the score, the most likely patients are adherent to treatment). Typically, patients are considered adherent when their score is at least 1–2 points for the MGL adherence scale. Due to excellent reliability, the MGL adherence scales are the most accepted adherence measures and are recommended as screening tools in clinical trials.

Each question is worth one point and the total score depicts the level of individual patient medication adherence; a score of 0 = high, 1–2 = medium, and scores 3–4 = low adherence.[16] Secondary outcomes include improvement in IOP of the study population. The IOP observed at baseline (T = 0 month) from tonometry results was compared with the IOP at the second, fourth, and sixth months. A self-designed, validated questionnaire was used as the study instrument in which patient demographics (age, socioeconomic status, and gender), clinical characteristics (comorbidities, medical and medication history), and glaucoma-related questions (disease history, eye surgery, and eye injury) were recorded. The eye drop instillation technique was also shown to patients through a video in a combined session where the researcher depicted the instillation technique using ophthalmic drops. Patient knowledge about glaucoma was also assessed at baseline and at the endpoint through close-ended questions, including whether they had any knowledge about (1) adherence to medication, (2) the consequences of non-adherence, (3) IOP range, (4) eye drop instillation technique, and (5) whether they had been through previous counselling sessions about glaucoma. These data were collected directly from patients and their medical files. Adherence scores and IOP recorded at baseline were compared with those recorded at each follow-up after two consecutive months until a period of 6 months. The questionnaire was validated through Cronbach's α with a value of 0.61 and translated into the native language through a double-blinding method with the help of language experts.

The research was conducted under the supervision of the intervention pharmacist who had been working as a hospital pharmacist in a private sector hospital in Lahore, Pakistan for the past 3 years. A training programme under the consultant ophthalmologist of the Department of Ophthalmology, SIMS was conducted and all studies were performed in the same hospital. This was a 2-week training programme in which all the basics of the Goldmann applanation tonometry test, eye drop instillation technique, and guidelines to counsel patients with glaucoma were covered. Furthermore, the researcher maintained intermittent contact with study participants in the interventional group for 2 months by using a social media application 'WhatsApp' group that included all the participants. In this group, the researcher consistently sent reminder texts and voice messages about medication adherence and its importance.

Statistical analysis

IBM SPSS Statistics 25 was used for statistical analysis. Demographics and clinical characteristics recorded at baseline were analysed through descriptive statistics. The proportions were compared using c^2 or Fisher's exact test, where appropriate. Mean adherence scores and IOP values of the control and interventional groups were compared before and after the interventions through paired t tests. For comparison of control and interventional groups classified in different IOP ranges, the Student t test was used at each interval. A comparison of the proportion of patients in the control and interventional groups with low, medium, and high adherence on the MGL adherence scale was performed by using the c^2 test. A p-value ≤ 0.05 was considered statistically significant.

Results

The results show that patients in the control and interventional groups had similar baseline demographics, including mean age, gender, literacy, employment, financial status, and comorbid conditions (p > 0.05 for all), as expressed in online supplemental Table I.

Glaucoma-related characteristics including symptoms, duration of disease, and IOP at baseline were similar in the control and interventional groups (p > 0.05), except for glaucoma medication, where patients in the interventional group were more likely to

Table I: Number of patients in control and interventional groups responding yes or no to MGL adherence scale from baseline to endpoint

Questions	Follow-ups	Control group (*n* = 50)		Interventional group (*n* = 50)		Total (*n*= 100)		*p*-value
		No	Yes	No	Yes	No	Yes	
		n (%)	*n* (%)	*n* (%)	*n* (%)	*n*	*n*	
Do you ever forget to instil your eye drops?	T=0	18 (36)	32 (64)	23 (46)	27 (54)	41	59	0.309
	T=1	19 (38)	31 (62)	27 (54)	23 (46)	46	54	0.07
	T=2	19 (38)	31 (62)	38 (76)	12 (24)	57	43	0.001*
	T=3	19 (38)	29 (58)	42 (84)	7 (14)	61	36	0.000*
Are you careless at times about instilling your eye drops?	T=0	18 (36)	32 (64)	20 (40)	30 (60)	38	62	0.68
	T=1	17 (34)	33 (66)	47 (94)	3 (6)	64	36	0.03
	T=2	17 (34)	33 (66)	48 (96)	2 (4)	65	35	0.010*
	T=3	15 (30)	33 (66)	47 (94)	2 (4)	62	35	0.000*
When you feel better, do you sometimes stop instilling your eye drops?	T=0	22 (44)	28 (56)	23 (46)	27 (54)	50	50	0.687
	T=1	29 (58)	21 (42)	41 (82)	9 (18)	70	30	0.009
	T=2	29 (58)	21 (42)	47 (94)	3 (6)	76	24	0.010*
	T=3	29 (58)	19 (38)	49 (98)	0	80	20	0.000*
Sometimes, when you feel worse, do you stop instilling your eye drops?	T=0	22 (44)	28 (56)	35 (70)	15 (30)	57	43	0.009
	T=1	23 (46)	27 (54)	38 (76)	12 (24)	61	39	0.035
	T=2	23 (46)	27 (54)	40 (80)	10 (20)	63	37	0.010*
	T=3	23 (46)	25 (50)	45 (90)	4 (8)	68	29	0.000*

*T=0, 1, 2, and 3 shows baseline, two months, four months, and six months, respectively. These questions are modified from Morisky Green Levine (MGL) adherence scale.

Table II: Comparison of patients in control and interventional groups with low, medium and high adherence on MGL adherence scale

	Group	Score 3–4 (low), *n* (%)	Score 1–2 (medium), n *n* (%)	Score 0 (high), *n* (%)	**p*- value
Baseline	Control	34 (68)	14 (28)	2 (4)	0.274
	Interventional	38 (76)	11 (22)	1 (2)	
Endpoint	Control	30 (60)	16 (32)	2 (4)	0.039*
	Interventional	6 (12)	19 (38)	19 (38)	

*Significant P value<0.05. Comparison of patients in control and interventional groups with low, medium and high adherence calculated using c2 test.

Table III: Improvement in mean MGL adherence score and IOP from baseline to endpoint (within group analysis)

Group	Baseline		Endpoint		Improvement		*t* value		**p*- value	
	MGL score	IOP (mmHg)	MGL score	IOP (mmHg)	MGL score	IOP (mmHg)*	MGL score	IOP	MGL score	IOP
Control group	3.3±1.5	21.5±8.8	3.09±1.2	20.0±8.4	0.22±0.2	1.4±0.4	2.89	4.23	0.358	0.061
Interventional group	3.28±1.3	21.8±9.3	1.18±0.91	16.1±9.4	2.1±0.4	5.7±0.07	5.61	7.95	0.017*	0.001

*Paired t test significant values<0.05 and data given as mean±SD, where p values between control and interventional groups are calculated using a paired sample t test and improvement in IOP is calculated in mmHg. IOP, intraocular pressure; MGL, Morisky Green Levine.

be on monotherapy compared with the control group according to statistical analysis ($p < 0.05$), as shown in online supplemental Table II.

Adherence to therapy

The MGL adherence scale was used to measure the adherence of both groups at baseline (T = 0), two follow-ups (T = 1, T = 2), and endpoint (T = 3). Each of the four questions consists of two possible answers: yes scores 1 while no scores 0. The lower the score on this scale, the more likely the patient is adherent to medication; 0, 1–2, and 3–4 scores depict high, medium, and low adherence, respectively.[16] The questions also indicate the reason for the patient's non-adherence, such as forgetfulness, carelessness, and missing dose intentionally after feeling better or worse. The number of patients with a 0 score for each question increased from T = 0 (baseline) to T = 3 (endpoint), as reflected in Table I.

The overall shift of interventional group's patients moving from low to high adherence in MGL Adherence Scale is shown in Table II, where both groups show no significant difference at baseline ($p = 0.274$) while after 6 months of pharmacist-led interventions, a significant difference between control and interventional groups can be seen at the endpoint ($p = 0.039$ which is < 0.05).

The mean MGL scores of control and interventional groups were analysed at baseline and compared with those at the endpoint

Table IV: Intraocular pressure status between treatment groups from baseline to endpoint

IOP (mmHg)	Control group	Interventional group	*p- value
Baseline			0.187
<15	3 (6)	6 (12)	
15–20	13 (26)	9 (18)	
21–22	23 (46)	25 (50)	
>22	11 (22)	10 (20)	
T=1			0.097
<15	4 (8)	7 (14)	
15–20	15 (15)	13 (26)	
21–22	22 (44)	23 (46)	
>22	9 (18)	7 (14)	
T=2			0.030*
<15	6 (12)	14 (28)	
15–20	16 (32)	21 (42)	
21–22	18 (36)	11 (22)	
>22	9 (18)	2 (4)	
Endpoint			0.018*
<15	7 (14)	15 (30)	
15–20	14 (28)	29 (58)	
21–22	20 (40)	2 (4)	
>22	7 (14)	2 (4)	

*P values calculated between control and interventional groups using independent t test with significant t test values<0.05. IOP, intraocular pressure.

using a paired t test. A significant relationship was found between the scores of patients in the interventional group before and after the educational interventions by pharmacists, as displayed in Table III.

Intraocular pressure

With the evident improvement in adherence scores of patients in the interventional group, improvement in IOP was also a marker of improved patient adherence to IOP-lowering medications. The IOP range was categorised into four classes: < 15, 15–20, 21–22, and > 22 mmHg. Patients were allocated into these classes according to their baseline IOP and followed up to the endpoint. By the end of the study, the number of patients in the interventional group who were classified in the safer IOP ranges (< 15 and 15–20 mmHg; $p < 0.05$) significantly increased, as shown in Table IV. The mean IOP between the control and interventional groups also showed significant improvement.

Patient glaucoma knowledge

The interventions consisted of one-on-one verbal counselling sessions with the individual patients at each follow-up session. The combined session also made patients in the interventional group aware of their normal and pathological IOP, the importance of sticking to their medication regime, and the ultimate consequences of non-adherence, such as irreversible blindness. These sessions significantly ($p < 0.05$) improved the patients' knowledge about glaucoma, including the importance of medication adherence, the consequences of non-adherence, and the standard four-step eye drop instillation technique, in comparison to the control group at endpoints, as expressed in Table V.

Although patients in the control and interventional groups had some prior knowledge about their IOP and they had also had brief counselling from their prescriber, the values show statistical significance for both groups even before interventions (at baseline). Furthermore, the differences in basic education levels of the patients in both groups could also have influenced the significant values of 'Patient glaucoma knowledge'; 40% of patients were graduates while the remaining 60% were undergraduates. Such differences could make the former patients more vigilant about their disease compared with the latter group.

Discussion

This study evaluated the impact of pharmacist-led interventions on glaucoma medication adherence in the geriatric population for 6 months. The primary objective of this study was to implement various pharmacist-led interventions and to evaluate their effect in geriatric patients with glaucoma. We found that the provision of individual verbal counselling, relevant material written in the

Table V: Comparison of glaucoma knowledge between control and interventional groups at baseline and follow-up

Questions	Follow-up	Control groupn (%)		Interventional group *n* (%)		*p-value
		Yes	No	Yes	No	
Importance of medicationadherence	Baseline	22 (-44)	28 (-56)	26 (-52)	24 (-42)	0.241
	Endpoint	24 (-48)	24 (-48)	46 (-92)	3 (-6)	0.030*
Consequencesof non-adherence	Baseline	26 (-52)	24 (-48)	28 (-56)	22 (-44)	0.283
	Endpoint	24 (-48)	24 (-48)	46 (-92)	3 (-6)	0.029*
Intraocular pressureknowledge	Baseline	32 (-64)	18 (-36)	35 (-70)	15 (-30)	0.010*
	Endpoint	35 (-70)	13 (-26)	49 (-98)	0	0.024*
Standard eye dropsinstillation technique	Baseline	18 (-36)	32 (-64)	22 (-44)	28 (-56)	0.198
	Endpoint	20 (-40)	28 (-56)	49 (-98)	0	0.010*
Prior counseling-sessionabout glaucoma	Baseline	36 (-72)	14 (-28)	37 (-74)	13 (-26)	0.045*
	Endpoint	42 (-84)	6 (-12)	49 (-98)	0	0.001*

*P-values between control and the interventional groups were compared using paired t-test for each question and paired t-test significant values < 0.05.

native language, a dose calendar to overcome forgetfulness, demonstration of eye drop instillation technique, and one-on-one pharmacist–patient interaction significantly improved adherence and IOP in geriatric patients with glaucoma.

Previously, such studies were conducted on larger cohorts with physician-centric interventions where no significant improvement in adherence was observed, and the researcher suggested that team collaboration with pharmacists might have a greater effect on medication adherence.[9] There are several other publications that used different approaches, for instance, telephone reminders and customised letters to improve appointment adherence in patients with glaucoma.[17] Similar research with the same study population (n = 100) found that patient education-based programmes are significant (p = 0.001) in improving patient knowledge about glaucoma.[12] Our study also provides significant results in this context, suggesting that it is possible to achieve better treatment outcomes with the inclusion of patient education programmes in conventional treatment methods. According to WHO's 2018 report on workforce alliance in Pakistan, the density of physicians is one per 10 000 patients, which has an immense burden on physicians[18]; the inclusion of pharmacists in patient counselling and education could be beneficial in improving patient compliance.

Our research includes several strategies to improve adherence, although we are not certain which aspect of our interventions proved out to be more effective. In future, further research should consider individual components of interventional programmes. A demonstration of the eye drop instillation technique to educate patients about safe and proper administration of ophthalmic drops, therapeutic hygiene, minimization of medication wastage, and accurate dosing was an effective intervention aid. In their study, Colome and colleagues concluded that eye drop administration in the geriatric population is a difficult activity and it can affect the expected treatment outcomes.[7] In overburdened public sector hospitals, the need for instructions about eye drop instillation can be overlooked. So, other healthcare workers such as pharmacists and nurses can assist in the management of ophthalmic diseases such as glaucoma and cataract.

Improvement in adherence produced lower IOP in the interventional group as patients became more conscious about their disease condition and medication adherence. Exceptions to improving IOP could include a few patients who had undergone changes in their medication regime or older patients who had been facing difficulties in administering their drops due to joint diseases such as arthritis. Only 72% of patients with newly prescribed medications refilled their prescription in a 12-month study to evaluate primary medication non-adherence.[19] Medication administration related problems due to comorbidities might be overcome by involving a family member in the care-giving process.[20] The results also suggest the need for the development of sustained release drugs and long-term effective treatment alternatives.

For geriatric patients, forgetfulness remains a constraining factor, even after three counselling and education sessions. Laster and colleagues recommend the use of alarms or similar electronic devices to act as reminders for older patients who are using pilocarpine ophthalmic drops.[21] We are living in the era of the internet and cell phones and the use of such devices to our best interests could do wonders in such healthcare management programmes. The availability of free medication in public sector hospitals in developing countries is also a huge constraint towards non-adherence as many patients in the lower-middle class cannot afford to buy their medications. In our study, the patients did not face any such problems, which might also contribute to improved adherence. More studies should be conducted on this particular aspect to evaluate the effect of medication non-availability on adherence in the lower-middle class population entitled to public sector hospitals.

Limitations

Our study has some limitations to be considered. Randomisation was not based on patients who were potentially non-adherent. Both groups had few patients who were already compliant with their medication regime, which could have influenced the results being significant. Also, few patients in the control group improved their adherence scores (4% of patients moved from low to medium adherence scores) and had better IOP (8% patients improved their IOP to ≤ 15 mmHg) at the endpoint compared with baseline. These results are influenced by physician interaction with patients, which could also have affected the results of the interventional group. Moreover, there was a difference in the level of education of the patients. Those having graduate degrees were in a better position to understand and comply with the educational interventions compared with patients with lower education levels. Our study was based on a small cohort (n = 100), which makes it convenient for the pharmacist to interact with patients individually. For larger cohorts, the results might differ. Additionally, this study did not analyse the effects of multiple dosage regimens on adherence. Patients with comorbidities might have to administer medications for each of their chronic conditions, which could affect overall patient compliance. Glaucoma is often treated by monotherapy with β blockers or prostaglandin analogues. If monotherapy is not effective in reducing IOP then second-line agents such as α agonists or topical carbonic anhydrase inhibitors can be added to one of the first-line treatment options.[5] Such prescribing might also affect non-adherence in patients undergoing combination therapy, which has not been considered by our study. Moreover, glaucoma medication may reflect glaucoma severity and all questions cannot be answered by one study because of differences between groups.

Conclusion

The pharmacist-led educational interventions in a public sector hospital were effective in improving adherence to glaucoma medications in the geriatric population. The results were complemented by improvements in IOP and adherence scores of

these patients. It is evident from the study that pharmacists can play a vital part in improving medication adherence of patients with glaucoma by providing dose calendars, periodic medication adherence reminders, brochures about disease management, counselling and educational sessions on glaucoma, and demonstrating the correct eye drop instillation technique.

What this paper

What is already known on this subject

- Geriatric patients are non-adherent to glaucoma medications because of complex eye drop instillation techniques.
- Physician-led educational interventions for patients with glaucoma who are non-adherent to medications showed some improved outcomes.

What this study adds

- The present study implemented various pharmacist-led interventions to improve adherence to glaucoma medications.
- The number of patients who were in the range of safe intraocular pressure significantly increased.
- The results showed that geriatric patients with glaucoma had improved adherence to medications.

Acknowledgements

The authors acknowledge Department of Ophthalmology, Services Institute of Medical Sciences, Lahore for their support. Moreover, the authors also thank Morisky.org for permission to use Morisky Green Levine (MGL) adherence scale.

Funding

Funding was provided by the Institute of Pharmacy, Lahore College for Women University, Lahore, Pakistan.

Competing interests

None declared.

Patient consent for publication Informed consent was obtained from all individual participants included in the study.

Ethics approval

The study was approved by Institutional Review Board of SIMS under reference No IRB/2019/532/SIMS.

Provenance and peer review

Not commissioned; externally peer reviewed.

Data availability statement

Data are available on reasonable request to corresponding author.

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References

1. Khouri AS, Fechtner RD. Primary open-angle glaucoma, in medical diagnosis and therapy. Elsevier Inc, 2014: 333–45.
2. Kingman S. Glaucoma is second leading cause of blindness globally. Bull World Health Organ 2004;82:887–8.
3. Newman-Casey PA, Robin AL, Blachley T, et al. The most common barriers to glaucoma medication adherence: a cross-sectional survey. Ophthalmology 2015;122:1308–16.
4. Hirooka K, Sato S, Nitta E, et al. The relationship between vision-related quality of life and visual function in glaucoma patients. J Glaucoma 2016;25:505–9.
5. Conlon R, Saheb H, Ahmed IIK. Glaucoma treatment trends: a review. Can J Ophthalmol 2017;52:114–24.
6. Jin H, Kim Y, Rhie SJ. Factors affecting medication adherence in elderly people. Patient Prefer Adherence 2016;10:2117–25.
7. Colomé-Campos J, Martínez-Salcedo I, Martorell-Hallado MC, et al. Objective evaluation of applying eye drops by elderly patients. Arch Soc Esp Oftalmol 2014;89:177–81.
8. Sleath B, Robin AL, Covert D, et al. Patient-reported behavior and problems in using glaucoma medications. Ophthalmology 2006;113:431–6.
9. Fiscella R, Caplan E, Kamble P, et al. The effect of an educational intervention on adherence to intraocular pressure-lowering medications in a large cohort of older adults with glaucoma. J Manag Care Spec Pharm 2018;24:1284–94.
10. Richardson C, Brunton L, Olleveant N, et al. A study to assess the feasibility of undertaking a randomized controlled trial of adherence with eye drops in glaucoma patients. Patient Prefer Adherence 2013;7:1025.
11. Esposito L. The effects of medication education on adherence to medication regimens in an elderly population. J Adv Nurs 1995;21:935–43.
12. Rendell J. Effect of health education on patients' beliefs about glaucoma and compliance. Insight 2000;25:112–8.
13. Stryker JE, Beck AD, Primo SA, et al. An exploratory study of factors influencing glaucoma treatment adherence. J Glaucoma 2010;19:66–72.
14. Carpenter DM, Tudor GE, Sayner R, et al. Exploring the influence of patient-provider communication on intraocular pressure in glaucoma patients. Patient Educ Couns 2015;98:1558–67.
15. Nkansah Net al. Effect of outpatient pharmacists' non-dispensing roles on patient outcomes and prescribing patterns. Cochrane Database Syst Rev 2010;2010:CD000336.
16. Beyhaghi H, Reeve BB, Rodgers JE, et al. Psychometric properties of the four-item morisky green levine medication adherence scale among atherosclerosis risk in communities (ARIC) study participants. Value Health 2016;19:996–1001.
17. Pizzi LT, Tran J, Shafa A, et al. Effectiveness and cost of a personalized reminder intervention to improve adherence to glaucoma care. Appl Health Econ Health Policy 2016;14:229–40.
18. WHO. Workforce alliance in Pakistan. WHO, 2018.
19. Fischer MA, Stedman MR, Lii J, et al. Primary medication non-adherence: analysis of 195,930 electronic prescriptions. J Gen Intern Med 2010;25:284–90.
20. Morgan C, McBeth J, Cordingley L, et al. The influence of behavioural and psychological factors on medication adherence over time in rheumatoid arthritis patients: a study in the biologics era. Rheumatology 2015;54:1780–91.
21. Laster SF, Martin JL, Fleming JB. The effect of a medication alarm device on patient compliance with topical pilocarpine. J Am Optom Assoc 1996;67:654–8.