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Original Article

Knowledge of medications among patients with glaucoma in Taiwan

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Background/Purpose: To investigate the knowledge and learning ability of glaucoma patients regarding their anti-glaucoma topical medications.
Methods: Patients on regular follow-up at the Glaucoma Clinic at Hsin-Chu General Hospital were recruited. After detailed ocular examinations, the participants were asked to recall and identify their glaucoma eye drops. The same test was repeated 3 months later. The results of both tests, the learning ability of patients regarding their glaucoma drugs, and the relationship between learning ability and demographic variables were evaluated.
Results: Two hundred eighty-seven glaucoma patients participated in this study. Of the study population, 25.8% and 57.1% could recall their topical mediation at the first and second tests, whereas 72.1% and 88.5% could identify their prescribed eye drops at the first and second tests, respectively. Approximately 34% of the participants showed improved knowledge at the repeat test, whereas 40% of the participants showed no improvement. Participants with a better learning ability were more likely to be younger, with a higher level of education, and with less visual field impairment.
Conclusion: The knowledge of glaucoma patients regarding their prescribed medication was deficient in Taiwan. Physician effort could improve knowledge on the prescribed drugs. Patient-centered education should be considered, targeting elderly individuals, illiterate individuals, and those with loss of visual function to increase compliance with glaucoma medication.

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Introduction

Glaucoma is one of the leading causes of irreversible blindness worldwide. A population-based study showed that one in 40 adults older than 40 years had impaired vision due to glaucoma.[1] It is estimated that 59.51 million people would be affected by glaucoma by 2020.[2] Long-term use of topical eye drops to lower intraocular pressure (IOP) remains the first-line therapy for glaucoma.

Persistent adherence to anti-glaucoma regimens is crucial for treatment efficacy.[3,4] However, similar to the findings on other chronic diseases, less than 50% of glaucoma patients persisted with therapy at one year.[3] A population-based study in Taiwan showed that only 24.2% of newly diagnosed patients continued to refill their prescriptions after 2 years.[5] Several factors have been identified to be associated with poor adherence such as patient and pharmacological characteristics,[6–9] insufficient knowledge of drugs,[10] and poor communication between the physician and patient.[8,11]

Adequate knowledge of medication has been recognized as one of the determinants of treatment compliance. Besides, adequate recall of prescribed drugs is a reflection of understanding of the treatment regimen.[12,13] The percentage of patients able to accurately identify their drugs varies from 10.9% to 85%.[11,14–17] Age, sex, household income, use of multiple medications, a low level of education, and first-time prescription of medication for glaucoma patients were associated with deficient knowledge about medication.[11,14] However, to date, research on the knowledge of medication on patients with glaucoma is limited. A study in the UK showed that knowledge of the name of the ocular disease and knowing the importance of the prescribed regimens were starting points to improve adherence.[18] Bloand et al., found that glaucoma patients who were non-adherent to treatment were less likely to name their medications correctly.[19] In another study, only 40% of patients showed less than 100% accuracy when tested twice about the name and dosage of glaucoma medications.[13] We conducted this study to further evaluate the knowledge and learning ability of glaucoma patients about their medication. We conducted this prospective study at a glaucoma specialist clinic to investigate the level of knowledge of glaucoma patients about topical ocular hypotensive treatment. We also evaluated possible factors that contributed to knowledge regarding medication.

Methods

Patients at the glaucoma subspeciality clinic using one or more topical hypotensive medications in one or both eyes were recruited into this study. Study approval was obtained from the Institutional Review Boards of the Hsin-Chu General Hospital and the principles of the Declaration of Helsinki were followed. After obtaining informed consent, ocular and social information was collected on each patient. Detailed eye examination, including best-corrected visual acuity (BCVA, converted to the log MAR scale), slit lamp examination, IOP measurement on a non-contact tonometer (TONOPACHY NT-530P, NIDEK co., LTD, Japan), fundoscopy, and visual field (VF) examination on an Octopus Visual Field

Analyzer (Interzeag AG, Berne, Switzerland), was performed. Only patients with at least two consecutive reliable VF results (false-positive and false-negative rate < 30%, fixation losses < 20%) were included. Patients with acquired color vision deficiency due to glaucoma, BCVA in the better-treated eye less than 0.1, inability to communicate, illiteracy, use of different medications in either eye, cognitive disability, and inability to complete two knowledge tests were excluded from the study.

After ocular examination, a trained staff member asked patients to recall the names of their topical glaucoma drugs. If they were unable to remember all the drugs correctly, they were asked to identify their medications from nine distinct topical glaucoma eye drops placed randomly on a desk. After the test, participants were informed that the same test would be carried out three months later. If one more correct answer was noted at the second, compared to the first test (e.g., a patient on three types of medication recognized one drug at the first test and two drugs at the second test), the participant was assigned a score of 1.

The severity of visual field loss was categorized as mild, moderate, or severe according to the mean defect between −3 to −8, −8 to −12, or less than −12 dB, respectively. The time interval from the initial diagnosis of glaucoma was classified from 1 to 4 based on a history of less than 3 years, 3–6 years, 6–9 years, and more than 9 years. The educational status was classified into 5 levels; level 0 if the participant had no diploma, level 1 if the participant was educated to the level of elementary school, level 2 if the participant was educated to junior high school level, level 3 if the participant was educated to high school level, and level 4 if the participant had attained post-secondary graduation.

We analyzed learning ability regarding recall and identification of medication as follows: Participants were assigned as level 1 if they did not recall or identify any glaucoma drug or showed no improvement of score at the repeat test; level 2 if they showed improvement in accuracy at the second test and level 3 if they gave correct answers at both tests.

We used the R program software to perform statistical analysis. The Spearman's rank correlation test was used to analyze the association between knowledge and discrimination with various demographic factors. Multinomial logistic regression test and classification tree were used to identify significant factors associated with improved learning ability. A p-value of <0.05 was set to determine statistical significance.

Results

Patient characteristics are summarized in Table 1. A total of 287 patients were enrolled in this study of which 180 (62.72%) were men. The mean age of the study population was 56.53 years (standard deviation, SD, 16.95) and the mean BCVA, 0.14 (SD 0.27). The mean VF loss of participants was −9.38 dB (SD 6.06).

Tables 2 and 3 present recall and identification of topical glaucoma medications. Only 74 (25.8%) study participants recalled their medication at the first test. Three months later, at the repeat test, more than twice as many patients

Table 1 Demographic and ocular characteristics of study participants.

Patients' data	Results (% or SD)
Gender, male	180 (62.72%)
Age, years	56.35 (16.95)
Better-eye visual acuity, log MAR	0.14 (0.27)
Intraocular pressure, mmHg	14.60 (3.80)
VF mean defect (average of both eyes), mean defect	−9.38 (6.06)
Length of glaucoma, grade	2.21 (1.17)
Number of glaucoma drugs	1.45 (0.66)
Education, level	2.98 (1.26)

Results were expressed as mean and standard deviation (in parentheses) except number and percentage (in parentheses) in gender.

(164 patients, 57.1%) could name their medications. As expected, visual identification of eye drops was easier than recall of names; 72.1% of participants could identify their eye drops at the first attempt, while 88.5% could do so at the second attempt.

The degree of improvement of recall and identification of topical glaucoma medications is shown in Tables 4 and 5. Predictably, patients who were only on a single medication had the highest rates of recall at both tests; 31.72% at the first and 76.88% at the second test. Similar rates of improvement (level 2) in recall were found regardless of the number of prescribed eye drops (34.95% in patients on one drug, 32.44% in patients on two drugs, and 33.33% in patients on three drugs). Besides, patients on two drugs had a similar rate of improvement in identification compared with those on three drugs (28.38% vs. 23.24%). Overall, 34.15% of participants had improved knowledge of their medication at the second test (level 2), while 40.07% of participants showed no improvement (level 1).

Table 6 shows the relationship between the learning ability to recall or identify about topical glaucoma medications and various demographic factors. Learning ability was positively associated with age, BCVA in log MAR (worse vision), less loss of VF, the duration of glaucoma, the number of eye drops, and the level of education. The ability to correctly identify medication was positively associated with less loss of VF and the level of education, and negatively associated with age, better vision, duration of glaucoma, and the number of glaucoma drugs.

Table 2 Distribution of recalling of topical glaucoma medications.

	With 1 drug	With 2 drugs	With 3 drugs
	Number (%)	Number (%)	Number (%)
First test			
Did not know any name of drugs	127 (66.28)	53 (71.62)	17 (62.96)
Knew 1 name of drugs	59 (31.72)	10 (13.51)	3 (11.11)
Knew 2 names of drugs	NA	11 (14.86)	3 (11.11)
Knew 3 names of drugs	NA	NA	4 (14.81)
Second test			
Did not know any name of drugs	62 (33.33)	35 (47.30)	12 (44.44)
Knew 1 name of drugs	124 (66.67)	10 (13.51)	1 (3.70)
Knew 2 names of drugs	NA	29 (39.19)	3 (11.11)
Knew 3 names of drugs	NA	NA	11 (40.74)
Total	186	74	27

Table 3 Distribution of identification of topical glaucoma medications.

	With 1 drug	With 2 drugs	With 3 drugs
	Number (%)	Number (%)	Number (%)
First test			
Did not identify any drugs	43 (23.12)	15 (20.27)	1 (3.7)
Identified 1 name of drugs	143 (76.88)	14 (18.92)	2 (7.41)
Identified 2 names of drugs	NA	45 (60.81)	5 (18.52)
Identified 3 names of drugs	NA	NA	19 (70.37)
Second test			
Did not identify any drugs	16 (8.6)	3 (4.05)	0
Identified 1 name of drugs	170 (91.40)	11 (14.86)	0
Identified 2 names of drugs	NA	60 (81.08)	3 (11.11)
Identified 3 names of drugs	NA	NA	24 (88.89)
Total	186	74	27

Table 4 Improvement of recalling of topical glaucoma medications in study participants.

	With 1 drug	With 2 drugs	With 3 drugs	Level
	Number (%)	Number (%)	Number (%)	
Full accuracy	59 (31.72)	11 (14.86)	4 (14.81)	3
Improve 1 score	65 (34.95)	12 (16.22)	2 (7.41)	2
Improve 2 scores	NA	12 (16.22)	4 (14.81)	2
Improve 3 scores	NA	NA	3 (11.11)	2
Others	62 (33.33)	39 (52.70)	14 (51.85)	1
Total	186	74	27	

Other included participants had less accurate responses or no improvement of score at the second test.

Table 5 Improvement of identification of topical glaucoma medications in study participants.

	With 1 drug	With 2 drugs	With 3 drugs	Level
	Number (%)	Number (%)	Number (%)	
Accurate twice	143 (76.88)	45 (60.81)	19 (70.37)	3
Improve 1 score	27 (14.52)	15 (20.27)	5 (15.82)	2
Improve 2 scores	NA	6 (8.11)	2 (7.41)	2
Improve 3 scores	NA	NA	0	2
Others	16 (8.6)	8 (10.81)	1 (3.7)	1
Total	186	74	27	

Other included participants had less accurate responses or no improvement of score at the second test.

Table 6 Spearman's rank correlation between learning ability of recalling knowledge/identification about topical glaucoma medications and demographic variables.

	Knowledge	Identification
Gender	0.04	0.06
Age	−0.35***	−0.34***
BCVA in log MAR	−0.29***	−0.32***
IOP reduction	−0.01	−0.02
VF, mean defect	0.39***	0.29***
Number of topical glaucoma drugs	−0.21***	−0.12*
Length of glaucoma, grade	−0.18***	−0.19***
Education, level	0.31***	0.29***

*Significance < 0.5; ***significance < 0.001.

In Fig. 1, the classification tree shows the correlation between learning ability and eight variables. The numbers of participants at three different levels (from left to right: 1−3) are shown beneath the rectangles. The numbers in the rectangles represent the level with the most participants.

Participants without learning ability (level 1; groups A, B, E, and G) tended to be older than 69.5 years with a lower level of education (less than 1.5); or older than 69.5 years with a higher level of education (more than 1.5), but with severe VF loss (mean defect more than 14.88 dB); younger than 69.5 years with glaucoma of more than 9 years duration, and VF defect between −4.775 and −16.75 dB; or younger than 69.5 years with glaucoma of less than 9 years duration, and mild VF loss between −4.775 and −5.975 dB.

Discussion

Patients who could correctly recall their medications also had a better understanding of the effects of their medications, according to a study conducted at primary healthcare facilities.[11] Furthermore, patients who were knowledgeable about their medication were more compliant with treatment than those who were not.[10] Therefore, the ability to name the prescribed medications appears to be the critical step to establish effective adherence to glaucoma therapy. Our results showed that only a quarter of participants knew the name of their glaucoma eye drops. Despite being reminded of the second test, over 40% of participants failed to recall their drugs. Old age, low education level, and severity of VF loss were related to lack of improvement of knowledge of medication.

Older people are more likely to have chronic diseases. Therefore, adherence to medication is very crucial to prevent disease progression. However, only 40% of outpatients, 8% of elderly admissions, and 12% of elderly discharges could name their medications in a previous study.[16] Patients with factors affecting adherence to glaucoma medication commonly seen in the elderly (physical or cognitive disability, lack of transport facility, and financial difficulties) were excluded from the present study.[8] It has been previously shown that inability to remember and lack of literacy may contribute to deficient knowledge on medications among the elderly.[11] Our findings corroborate with those of the above study; we showed that older patients with a low education level and worse VF defect showed no improvement in naming or identifying their glaucoma drugs. However, two subgroups of participants younger than 69.5 years also revealed lack of improvement, including those with a shorter duration of glaucoma and minimal VF defect, and those with a longer duration of glaucoma and moderate loss of VF. The possible explanation for this finding could be that patients at an early stage of glaucoma may be unaware of the consequence of visual loss. Patients who suffered from glaucoma for several years were only used to refill of medications and reluctant to accept further information about their medication.

Our findings, in accordance with the study by Tang et al., showed that the education level of patients was an important factor associated with knowledge of medication.[12] A previous study showed that only 10.9% of patients recalled their medications correctly; the main reason for such a low rate was considered to be the poor education level of the study participants.[11] Another study on glaucoma patients showed a significant difference in the accuracy of reporting of prescribed medications between
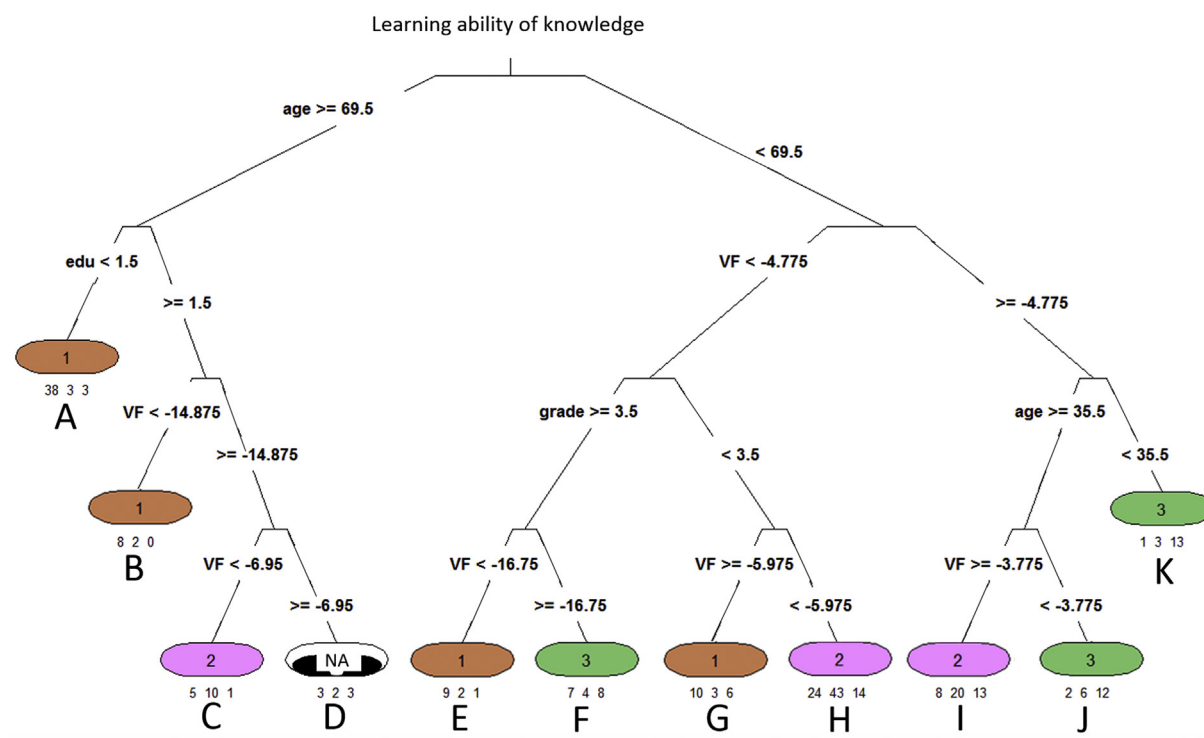
Figure 1 Demographic and clinical variables associated with learning capacity of knowledge regarding glaucoma medications were conducted with classification tree analysis. A significant proportion of participants without learning capacity (level 1; groups A, B, E, and G) were older than 69.5 years and lower education attainment (less than 1.5).

populations who completed high school and those that did not.[13]

Most studies demonstrated that complicated glaucoma dosing regimens are related to poor persistence with treatment.[13,20] In contrast, two large-scale studies showed that patients on multiple ocular hypotensive eye drops had better adherence to treatment.[5,21] This may be because patients who need multiple drugs are those with difficult IOP control or with more severe glaucomatous damage. Accordingly, they may be more compliant with treatment to prevent the possible development of blindness. However, the number of glaucoma drugs did not appear to be a significant predictor of learning capacity in this study. Regarding the benefits of clinical education, all our study participants were followed up at the glaucoma clinic for at least 6 months. If the study participant did not recall or identify medication at the first test, Dr. Ko familiarized the patient about the number of drugs, their names, dosing, and associated side effects. Our study demonstrated that education imparted by the treating physician did not improve knowledge about medication in all study participants. We believe that factors that affect learning ability identified in the current study would provide information for establishing future strategies to improve knowledge of glaucoma medications.

In summary, the findings of our study confirm that knowledge of glaucoma medications remains insufficient in Taiwan. The level of knowledge may be improved after a reminder by the treating physicians. Physicians in practice should encourage patients to have a better understanding about their medications, especially those who are elderly, illiterate, and have loss of visual function.

Conflicts of interest

Acknowledgments

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