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Research Article

Highlighting the Issues Associated with Glaucoma Medication Therapy: An Evaluation of Pharmaceutical Care

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Abstract

Background: Drug therapy problems are the main obstacle in the management of chronic diseases. Improper use of medications and non-adherence to medication use are regarded as major factors halting the management of glaucoma. ***Aim***: The present study was designed to shed light on the problems associated with medication therapy for patients with glaucoma in Sulaimani City. ***Method***: A cross-sectional study was conducted on fifty patients with glaucoma. Questionnaires were used for demographic data, the patient's quality of life, and adherence. Patients were assessed for dry eye by using Schirmer's test type 1. Drug therapy problems (DTPs) and drug interactions were checked using the Medscape interaction database. ***Results***: 60% of the patients were washing their hands before administering eye drops. The majority of patients had the correct position of the head during the administration. While 60% of the patients were closing their eyes after the administration for 2 or 3 minutes. Regarding adherence, only 24% of patients were perfectly adherent to medication use. Noncompliance with their treatments and adverse drug reactions were the most commonly observed DTPs. Thirty-seven of the patients had a metallic taste, and the most common type of drug interactions were significant interactions. ***Conclusion***: The absence of pharmaceutical care has led to many problems associated with the improper use of antiglaucoma drugs. Pharmacists may play a pivotal role in improving the outcomes of patients with glaucoma.

***Keywords*:** Pharmaceutical care, Glaucoma, Drug therapy problems, Clinical pharmacist

تسليط الضوء على القضايا المرتبطة بالعلاج الدوائي للجلوكوما: تقييم الرعاية الصيدلانية

الخلاصة

الخلفية: مشاكل العلاج الدوائي هي العقبة الرئيسية في علاج الأمراض المزمنة. يعتبر الاستخدام غير السليم للأدوية وعدم الالتزام باستخدامها من العوامل الرئيسية لفشل علاج الجلوكوما. **الهدف**: تم تصميم الدراسة الحالية لتسليط الضوء على المشاكل المرتبطة بالعلاج الدوائي لمرضى الجلوكوما في مدينة السليمانية. **الطريقة**: أجريت دراسة مقطعية على خمسين مريضا يعانون من الجلوكوما. تم تسجيل البيانات الديموغرافية، ونوعية حياة المريض، والالتزام. تم تقييم المرضى لجفاف العين باستخدام اختبار شيرمر من النوع 1. تم فحص مشاكل العلاج الدوائي والتفاعلات الدوائية باستخدام قاعدة بيانات تفاعلات Medscape. **النتائج**: 60٪ من المرضى كانوا يغسلون أيديهم قبل إعطاء قطرات العين. كان لدى غالبية المرضى الموضع الصحيح للرأس أثناء العلاج. بينما كان 60٪ من المرضى يغلقون أعينهم بعد الإعطاء لمدة 2 أو 3 دقائق. فيما يتعلق بالالتزام، كان 24٪ فقط من المرضى ملتزمين تماما باستخدام الأدوية. كان عدم الامتثال لعلاجاتهم والتفاعلات الدوائية الضارة هي الأكثر شيوعا. كان لدى سبعة وثلاثين من المرضى طعم معدني، وكان النوع الأكثر شيوعا من التفاعلات الدوائية هو التفاعلات المهمة. **الأستنتاج**: أدى غياب الرعاية الصيدلانية إلى العديد من المشاكل المرتبطة بالاستخدام غير السليم للأدوية المضادة للجلوكوما. قد يلعب الصيادلة دورا محوريا في تحسين نتائج مرضى الجلوكوما.

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INTRODUCTION

Glaucoma is characterized by progressive deterioration of the optic nerve, ganglion cell loss, and thinning of the retinal nerve fibers. It is the most frequent factor in permanent blindness [1,2]. More than 70 million people have glaucoma, and 10% of them are bilaterally blind [3,4]. By 2040, it is predicted that 111.8 million people will have glaucoma, which can be attributable to an aging population [3]. Glaucoma does not cause discomfort; however, it is accompanied by an obvious elevation of intraocular pressure (IOP); additionally, visual symptoms do not appear until the illness has advanced [5]. There are several clinical manifestations of glaucoma, and its etiology is complicated, multifaceted, and poorly understood [3,6,7]. The three main types of glaucoma are primary, secondary, and the less common juvenile and congenital forms [8]. Each of these types can be classified as either open-angle glaucoma or close-angle glaucoma. Secondary glaucoma could be caused by trauma, inflammation, or drug-induced [9]. The only modifiable risk factor for the illness is intraocular pressure (IOP), while age, race, ethnicity, family history of glaucoma, myopia, type 2 diabetes mellitus, and central corneal thickness are all unmodifiable risk factors. The main goal of glaucoma therapy is to decrease IOP to a level that attenuates further injury to the optic nerve head (ONH) and loss of vision [3]. This can be achieved either by medications, laser treatment, or surgical procedures [1]. Topical eye drops that aim to decrease ocular hypertension are the first line of treatment [10], such as prostaglandin analogs [1] and beta blockers [11]. Carbonic anhydrase inhibitors are considered the third line of treatment [12]. Combination therapy is another approach to treating glaucoma. Like prostaglandin analogs or carbonic anhydrase inhibitors with beta-blockers, this approach has been shown to be more effective than monotherapy [13]. The obstacle in the management of chronic diseases is the adherence of patients to the proper use of medications; non-adherence to medication use is considered a major factor halting the management of glaucoma [14]. Many factors contributed to patient adherence failures, like side effects of the drugs, lack of enough information about the seriousness of the disease, use of more than one medication, absence of clear symptoms of the disease, and high treatment costs [14,15]. Additionally, proper application of eye drops plays a critical role in a disease like glaucoma, which requires lifelong administration of medication. [15,16]. The majority of glaucoma patients are unable to appropriately infuse eye drops, and this directly contributes to overmedication with systemic absorption, negative effects, and a susceptibility to infection from contaminated bottle tips, in addition to ocular abrasions and ulcerations [17,18]. Furthermore, when administering topical glaucoma drugs into the eye, the provided dosage may be lost by punctum route and leakage, leading to inadequate therapy, disease progression, or the requirement for additional, more intrusive treatment approaches [18-20]. In spite of the presence of many studies performed in Sulaimani city focusing on the role of pharmacists in highlighting and minimizing the problems associated with improper uses of medications in many chronic diseases such as T2DM [21], hypertension, chronic kidney disease [22], and medication errors in pediatrics [23], we didn't find any study on the problems associated with the use of medications in glaucoma. Accordingly, the present study was designed to shed light on the problems associated with glaucoma treatment in Sulaimani City.

METHODS

This cross-sectional study was conducted on patients with glaucoma during the period (March 2022 to July 2022) at Shahid Aso Hospital in Sulaimani City. Informed written consent was obtained from all the participants prior to study commencement. A clinical pharmacist used questionnaires to interview patients with glaucoma. The questionnaires used in the current study have been validated and translated into the native language. The inclusion criteria included being diagnosed with glaucoma, using at least one anti-glaucoma medication for at least 6 months, routinely self-instilling eye drops, and being ready to participate in the study. The current study's questionnaires asked about demographics, glaucoma-related factors, and medication-related factors, such as the number of topical eye drops, the type of topical anti-glaucoma medications, instructions on how to use eye drops and other prescription medications, and whether or not eye drop medicine was taken as prescribed. In addition, the patients were asked to use artificial tear eye drops in one eye in order to observe how they used antiglaucoma eye drops. Furthermore, patients' quality of life was assessed using the Glaucoma Quality of Life-15 questionnaire (GQL-15). The study also included reporting systemic and local side effects experienced by patients in addition to the use of a slit lamp examination. The ocular examination conducted for each patient included intraocular pressure, the visual field defect of the worse eye, and the cup-to-disc ratio (CDR) of the worse eye. In addition, patients were assessed for dry eye by using Schirmer's test type 1 without anesthesia for 5 minutes with their eyes. The Schirmer test was graded as follows: >10 mm, normal; 8–10 mm, mild; 5-7 mm, moderate; and 5 mm, severe [24]. The Hodapp-Parrish-Anderson criteria were used to classify people with glaucoma as mild (mean deviation -6 dB), moderate (mean deviation -6 dB but > -12 dB), or severe (mean deviation -12 dB) based on how bad their worse eye's vision was [25]. In the current study, the Hill-Bone Scale was used for the evaluation of adherence among

patients [26,27]. For glaucoma disease, only seven items are suitable for evaluating medication adherence. According to the protocol of the medication-taking subscale of the Hill-Bone Scale, patients are considered adherent to the treatment when the total score for each patient ranges from 7 (perfect adherence) to > 7 (imperfect adherence). Drug therapy problems (DTPs) were identified in each patient using the European Glaucoma Society Terminology and Guidelines for Glaucoma based on Cipolle's method. DTPs are classified into 7 categories, which include the following [28]: Unnecessary drug therapy, need for additional drug therapy, ineffective drug therapy, overdose, sub-therapeutic dose, adverse drug reaction, and noncompliance. Drug interactions were also checked using the Medscape interaction database. According to this database, drug interactions are classified into five categories: none, minor, significant (monitor closely), serious (use an alternative), and contraindicated [22]. The quality of life was assessed using a specific questionnaire (GQL-15), which comprises 15 questions and is categorized into 4 domains, including central and near vision, peripheral vision, dark-light adaptation, and outdoor activity. The scoring of each score begins from 0-5, with the criteria: 0 = Do not fill in for reasons that are not related to eye sight; 1 = no difficulty; 2 = little difficulty; 3 = occasional; 4 = rather severe difficulty; 5 = severe difficulty. In addition, it was categorized into 2 categories by using a cutoff point, where it is considered good quality of life when the score is < 34, whereas bad quality of life scores >34 [29,30].

Research Ethics Approval Statement

The research protocol was approved by the ethical committee of the College of Pharmacy, University of Sulaimani with the registration number (PH46-22 on 10/01/2022).

Statistical analysis

The statistical analysis was performed using GraphPad Prism 8. The values of the measured parameters were expressed as percentages using a one-sample t-test and the Wilcoxon Rank test.

RESULTS

The demographical data of the participants showed that the total number of glaucoma patients in the present study was 50. The majority of the study sample was more than fifty years old. Sixteen patients were aged between 60 and 69 years. Twenty-four patients were male and 26 were female. Most of the participants (30) had other comorbidities, and 20 patients had hypertension. Twenty-nine of the patients were literate, and 38 of them resided in urban areas (Table 1).

Table 1: Demographical data of the study sample

Gender	Male	24
	Female	26
Age	< 40	4
	40-49	4
	50-59	10
	60-69	16
	70-79	12
	80-89	4
Comorbidities	Yes	30
	No	20
	Hypertension	20
	Supraventricular tachycardia	4
	Benign prostatic hyperplasia	2
	Diabetes mellitus	14
	Depression	1
	Hypothyroidism	1
	Pulmonary fibrosis	1
	Coronary heart disease	4
	Rheumatoid arthritis	1
Education level	Illiterate	21
	Literate	29
Residence	Rural	12
	Urban	38

Table 2 demonstrates glaucoma-related factors; the majority of patients (41) were on glaucoma treatment for more than two years. Twenty-four patients had severe glaucoma, while those with mild and moderate glaucoma were 14 and 12, respectively. Only 16 patients had a family history of glaucoma. The most common type of glaucoma (44 patients) was primary open angle glaucoma. Meanwhile, only 8 patients had IOP in the worse eye (>20). Most of the patients (44) bilaterally used medicine, and 9 patients had CDR of the worse eye (>9).

Table 2: Glaucoma-related factors

Duration of diagnosis and treatment	< 1 year	5
	1-2 year	4
	> 2 years	41
Visual field defect of the worse eye	Mild	14
	Moderate	12
	Severe	24
Glaucoma family history	Yes	16
	No	34
Types of glaucoma	POAG	44
	PACG	4
	NTG/LTG	0
	PXFG	0
	Glaucoma suspect	2
IOP of the worse eye	≤ 15	17
	15-17	14
	17-20	11
	> 20	8
Use of medicine	Unilateral	6
	Bilateral	44
CDR of the Worse eye	≤ 0.7	21
	0.7-0.9	20
	>0.9	9

Cup-to-disc ratio (CDR), Intraocular pressure (IOP), Primary open-angle glaucoma (POAG), Primary angle closure glaucoma (PACG), Normal-tension glaucoma (NTG), Low-tension glaucoma (LTG), Pseudoexfoliative glaucoma (PXFG).

The majority of the patients (26) were taking two eye drops. Almost all the patients (49) got information from the physician regarding the technique of using eye drops. Additionally, thirty patients were taking other prescription medications, and 25 were taking other combination therapies (Table 3).

Table 3: Medication-related characteristics

Number of topical eye drops	1	18
	2	26
	3	6
Type of topical medications	Monotherapy	12
	Fixed combination therapy	38
Get instruction regarding the technique of using eye drops	Physician	49
	Pharmacist	1
Take other prescription medication	Yes	30
	No	20
Other prescription medication	Monotherapy	5
	Combination therapy	25

Moreover, Table 4 shows the frequency of various types of topical antiglaucoma drugs that were being administered by the patients, including prostaglandin (PG) analogs (latanoprost) in 39 patients, Alpha-2 agonists (brimonidine), Beta Blockers (Timolol), and carbonic anhydrase inhibitors (dorzolamide). About 46% of the patients were taking Timolol+ Dorzolamide FC, Latanoprost, followed by Latanoprost (16%), and Timolol+ Dorzolamide FC (14%).

Table 4: Frequency and types of topical anti-glaucoma drugs used by the study sample

Treatment	*n*(%)
Latanoprost	8(16)
Brimonidine	3(6)
Timolol	1(2)
Timolol+Dorzolamide FC	7(14)
Latanoprost, Dorzolamide	1(2)
Timolol, Latanoprost	1(2)
Timolol+Dorzolamide FC; Latanoprost	23(46)
Timolol+Dorzolamide FC, Brimonidine, Latanoprost	6(12)

In the current study, only 30 patients (60%) were washing their hands before administering eye drops. The majority of patients (90%) had the correct position of the head during the administration, while 33 patients (66%) were closing their eyes after the administration for 2 or 3 minutes. In contrast, almost all of the patients (98%) did not know that they had to close the nasolacrimal duct after administration. Only 13 (26%) patients contacted the bottle dropper with their eyes or fingers while instilling the drop. About 22 (44% of the patients) pulled down the lower eyelid to form a pocket, and the eye drops fell beside the eye in most of the patients (86%). Half of the patients (50%) squeezed more than one eye drop. Among the fifty patients, 32 had more than one eye drop, and only 3 (9.3%) patients did not wait 5 minutes between different medications (Table 5).

Table 5: Patients' knowledge and behavior toward medications use

Behavior	Type	*n*(%)
Wash hands before administration	Yes	30(60)
	No	20(40)
Correct position of the head during the administration	Yes	45(90)
	No	5(10)
Closing the eyes after administration for 2 or 3 minutes	Yes	33(66)
	No	17(34)
closing the nasolacrimal duct after administration	Yes	1(2)
	No	49(98)
Contact of the bottle- dropper with eyes or fingers	Yes	13(26)
	No	37(74)
Pulling down the lower eyelid to form a pocket	Yes	22(44)
	No	28(56)
Notice eye drops fall beside the eye	Yes	43(86)
	No	7(14)
Squeezed more than one eye drop	Yes	25(50)
	No	25(50)
Waiting 5 minutes between different medications. (If the patient has more than one medication)	Yes	29(90.62)
	No	3(9.37)

Regarding adherence, the response to medication taking subscale of the Hill-Bone Scale showed that only 12 (24%) of patients were perfectly adherent to medication use using the modified Hill-Bone Scale (Table 6). The Hill-Bone questionnaire originally contained three subscales. However, only medication-taking subscales were suitable for our study. The distributions of questionnaires are shown in Table 6.

Table 6: Patients' adherence to medication-taking subscale Hill-Bone

Medicine-taking	None of the time (1 pt)	Some time (2 pts)	Most of the time (3 pts)	All time (4 pts)
1. How often do you forget to take your eye drops medicine?	12	17	17	4
2. How often do you decide not to take your eye drops medicine?	38	1	7	4
3. How often do you forget to get prescriptions filled?	42	3	2	3
4. How often do you run out of eye drops pills?	31	6	5	8
5. How often do you skip your eye drops medicine before you go to the doctor?	28	8	6	8
6. How often do you take someone else eye drops?	42	3	2	3
7. How often do you miss taking your eye drops when you are careless?	30	8	8	4
Medication-taking subscale of the Hill-Bone Scale	Level of Adherence			Frequency
	Perfect adherence (score = 7)			12 (24%)
	Non-adherence (score >7)			38 (76%)

Among the nine items of medicine taken from the Hill-Bone Scale tool, seven were used. Noncompliance with their treatments and adverse drug reactions were the most commonly observed DTPs (74% and 76%, respectively), followed by sub-therapeutic dose 12%, unnecessary drug treatment 9.25%, need for additional drug therapy 4.6%, ineffective drug therapy 1.8%, and overdose 1.8% (Figure 1).

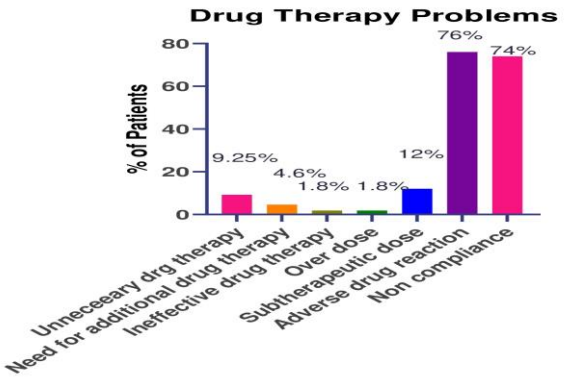

Figure 1: Description of DTPs of the study sample.

The study revealed that the most common reasons for non-compliance with the treatments (76%) were forgetfulness, followed by the cost and availability problem (40%), inability to self-administer the drug product appropriately (30%), lack of understanding the instructions (28%), and a preference not to take the medication (16%) (Figure 2).

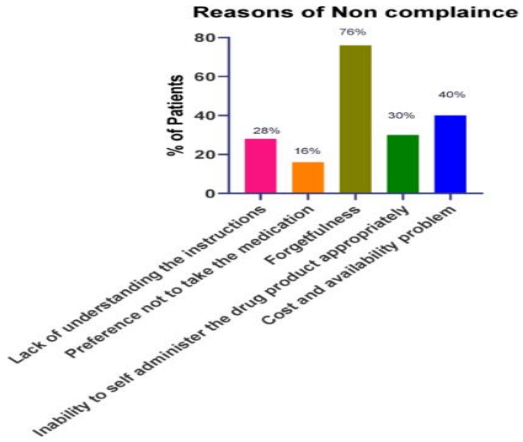

Figure 2: Reasons of noncompliance with the therapy

Regarding systemic side effects of anti-glaucoma drugs, metallic taste, breathlessness, and headache were observed. Out of 50 patients, 11 (22% of the patients) did not have any systemic side effects. Thirty-seven patients (74%) had a metallic taste, mostly in patients using dorzolamide in their regimen. Breathlessness was reported in 7 patients (14%) who used timolol in their regimen, and headache was also observed in 13 patients (26%) who used mostly dorzolamide in their regimen (Table 7).

Table 7: Incidence of systemic side effects of anti-glaucoma drugs

Drugs	*n*	Systemic side effects			
		None	Metallic taste	Breathless	Headache
Latanoprost	8	6	1	0	1
Brimonidine	3	2	1	0	0
Timolol	1	0	1	0	0
Timolol+Dorzolamide FC	7	1	4	1	1
Latanoprost; Dorzolamide	1	0	1	0	1
Timolol; Latanoprost	1	0	1	0	0
Timolol+Dorzolamide FC; Latanoprost	23	2	22	3	7
Timolol+Dorzolamide FC; Brimonidine; Latanoprost	6	0	6	3	3
Total	50	11 (22%)	37 (74%)	7 (14%)	13 (26%)

Table 8 demonstrates the incidence of local adverse reactions in different anti-glaucoma drug combinations (monotherapy and polytherapy). Among 50 patients, 94 eyes were on treatment, and only 11 (11.7%) of the patients' eyes did not have any local adverse reactions. The most common adverse reactions observed were foreign body sensation, dry eyes, and redness, with incidences in 37 (39.36%), 34 (36.17%), and 32 (34%) of patients' eyes, respectively.

Table 8: Incidence of local adverse reactions of anti-glaucoma drugs

Drugs	No. of patients eyes	Local adverse reactions																
		No	Yes															
			Iris pigment epithelial cyst	Allergic blepharoconjunctivitis	Follicular conjunctivitis	Redness	Burning sensation	Blurred vision	Itching	Brow ache	Lengthened eyelashes	Periocular hyperpigmentation	Deepening of superior sulcus	Iris heterochromia	Foreign body sensation	Dry eyes	Subconjunctival fibrosis	Eyelid erythema
Latanoprost	14	2	0	1	0	4	5	3	1	0	0	0	0	0	5	5	0	0
Brimonidine	6	0	0	2	0	2	0	2	2	0	0	0	0	0	6	6	0	0
Timolol	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Timolol+ Dorzolamide FC	14	0	0	2	0	8	8	6	2	0	0	0	0	0	4	4	0	0
Latanoprost; Dorzolamide	2	0	0	0	0	0	0	2	0	2	0	0	0	0	2	2	0	0
Timolol; Latanoprost	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Timolol+ Dorzolamide FC; Latanoprost	44	6	0	7	2	15	15	8	7	3	1	0	0	0	12	10	0	0
Timolol+ Dorzolamide FC; Latanoprost, Brimonidine	11	0	2	2	0	3	3	3	3	1	0	0	0	0	8	7	0	0
Total	94	11 (11.7%)	2 (2.1%)	14 (14.8)	2 (2.1%)	32 (34%)	31 (32.97%)	24 (25.5%)	15 (15.9%)	6 (6.3%)	1 (1.06%)	0 (0%)	0 (0%)	0 (0%)	37 (39.36%)	34 (36.17%)	0 (0%)	0 (0%)

The most common type of drug interactions reported in patients' prescriptions were significant interactions (55%), followed by minor interactions (31.5%) and serious interactions (13%) (Figure 3).

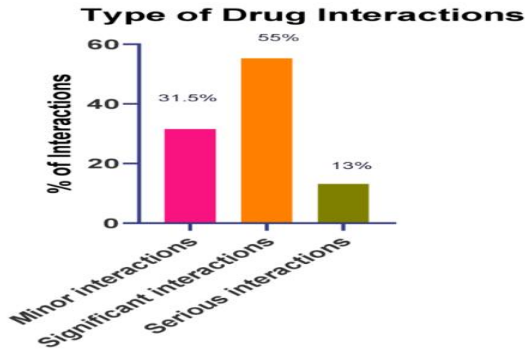

Figure 3: Drug interactions in patients' prescription.

Among 50 patients diagnosed with glaucoma, 94 eyes were on treatment. Based on Schirmer's 1 test, 53 of the patients' eyes observed a reduction in the quantity of tears (57%), with 19 (20.21%), 27 (28.72%), and 7 (7.44%) of the patients' eyes showing mild, moderate, and severe reductions in the quantity of tears, respectively (Figure 4).

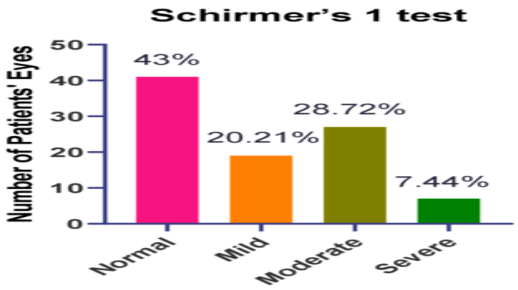

Figure 4: Results of Schirmer's 1 test.

In the present study, Table 9 displayed the quality of life of patients with glaucoma that are categorized into 2 categories by using a cutoff point: good quality of life score < 34 and bad quality of life score >34. The result revealed that 30 patients (60%) had good quality of life, while 20 patients (40%) had bad quality of life.

Table 9: Patients' Quality of Life (Glaucoma GQL-15)

Questions	0	1	2	3	4	5
Reading newspapers	24	12	12	1	1	0
Walking after dark	0	8	27	5	6	4
Seeing at night	0	8	25	7	6	4
Walking on uneven ground	0	13	24	5	3	5
Adjusting to bright lights	0	7	25	8	5	5
Adjusting to dim lights	0	7	26	7	7	3
Going from light to dark room or vice versa	0	7	26	5	7	5
Tripping over objects	0	18	20	4	4	4
Seeing objects coming from the side	0	10	16	6	7	11
Crossing the road	0	13	27	3	5	2
Walking on steps/stairs	0	12	25	4	4	5
Bumping into objects	0	18	20	4	4	4
Judging distance of foot to step/curb	0	12	25	4	5	4
Finding dropped objects	0	8	28	3	6	5
Recognizing faces	0	13	25	5	2	5
Patient's quality of life	Good quality			30 (60%)		
	Bad quality			20 (40%)		

Note: (0 = abstinence from activity owing to non-visual reasons, 1 = no difficulty, 2 = a little bit of difficulty, 3 = some difficulty, 4 = quite a lot of difficulty, 5 = severe difficulty)

DISCUSSION

The main core of pharmaceutical care is the patient. It concerns providing maximum service to ensure the proper administration of medications and attenuating the incidence of adverse reactions accompanied by the improper use of medication. Additionally, pharmaceutical care aims to improve the quality of life of patients [31]. The philosophy of pharmaceutical care makes it clear that the duty of the practitioner of pharmaceutical care to society is to ensure appropriate and secure medication use [32]. This study aimed to highlight all the problems associated with medication therapy for patients with glaucoma in the absence of pharmaceutical care. To the best of our knowledge, this is the first study to shed light on the importance of pharmaceutical care in addressing all the problems associated with medication therapy for patients with glaucoma in our region. The study revealed that more than half of the patients washed their hands before administering eye drops. This result is in accordance with other studies [33], whereas other studies reported lesser numbers showing this behavior [18,34]. Moreover, the results showed that the majority of patients had the correct position of the head during the administration, and less than half (44%) of the patients pulled down the lower eyelid to form a pocket. Furthermore, more than half of the sample knew to close their eyes after administration for 2 or 3 minutes. The majority of the study sample did not know to close the nasolacrimal duct after administration. These findings were in accordance with other studies [19,16,35,36]. According to the results of the present study, only 26% of the patients contacted the bottle-dropper with their eyes or fingers while instilling the drop; this nearly resembles the finding of other studies [36,34]. This behavior increases the risk of contamination through contact with the tip of the bottle and may hurt the eye [18]. Furthermore, we observed that the eye drops fell beside the eye in 86% of the patients. This result was in contrast to previous studies [17,18,35]. Improper use of these eye drops has many unwanted consequences, such as disease progression, dermatitis, and wasting part of the drops, which raises economic issues for the patient and the insurance companies [18]. Moreover, the present study showed that almost all the patients had an improper technique for using eye drops, and they did not get any instructions regarding the technique of using eye drops from the pharmacist. Pharmacists can play a critical role in educating patients with glaucoma regarding the proper technique for using eye drops [17,37]. Patients adherence to medication is another important issue that is directly related to therapeutic effectiveness and the economic burden on the healthcare system [38]. Medication adherence was assessed using the Hill-Bone Scale, and the findings indicated that only 24% of patients adhered to the treatment, which is not consistent with the findings of other studies that showed a higher percent of adherence in the study samples. [39-42] This difference could be explained by the fact that our patients did not receive any treatment counseling by a pharmacist, and the absence of pharmaceutical care may negatively affect the outcome of the disease [43]. In the present study, the patients relate the major reasons behind non-compliance to forgetting to take medications and affordability problems. The cause of forgetfulness could be due to the aging process because most of the study sample was between 50 and 89. These outcomes are in accordance with other studies that indicated that forgetfulness was cited as the major reason for non-adherence [39,44]. Together with other healthcare experts, pharmacists, as a member of the team, have a pivotal role in assessing adherence and spotting potential obstacles. In the long run, pharmacists can communicate with patients and collaborate with other healthcare professionals, which would be more successful in persuading patients to follow the advice of the healthcare team [45,46]. Patients can be encouraged to take their medications properly by receiving appropriate education about the use of their medications for achieving the best possible therapeutic results and illness management. Additionally, studies showed that patients who received full pharmaceutical care and counseling sessions conducted by a clinical pharmacist

showed higher levels of medication adherence and successful therapeutic outcomes [37,47,48]. According to the results of the current study, noncompliance and adverse drug reactions were the top two problems among DTPs. Drug therapy problems may result in poor patient outcomes. It has the potential to aggravate patient health conditions, result in death, extend hospital stays for patients, raise the direct cost of medical care, and lower patients' satisfaction and quality of life. Pharmacists can play a critical role in recognizing, identifying, and addressing these issues [48]. The majority of the patients experienced systemic side effects, and a metallic taste was reported in most of the study sample, followed by headaches and breathlessness. In contrast to these findings, a study done by Bhagat *et al*. reported very few systemic side effects [49]. The discrepancy between these two findings could be attributed to poor eye drop technique in the current study. Regarding the local adverse reactions observed in the current study, the most common ones were foreign body sensations, dryness, and redness. Furthermore, eye drops containing benzalkonium chloride, when used for a long period of time, could contribute to decreasing tear film stability [49]. Side effects of topical glaucoma therapy have shown a direct effect on treatment satisfaction, adherence to therapy, and vision-related quality of life [50]. A pharmacist can reduce the incidence of adverse drug reactions by reviewing the medications and giving instructions on the proper technique for using eye drops [51]. Additionally, pharmacists can educate patients to use antiglaucoma-free preservatives and/or recommend using artificial tears with their treatments. Studies proved that the absence of preservatives in eye drops may be linked with fewer adverse effects [50,52]. Drug-drug interactions are another important issue that needs to be addressed and solved by the clinical pharmacist. Significant interactions were noticed in more than half of the patients in the present study. Many drug-drug interactions may occur when antiglaucoma drugs are taken concomitantly with cardiovascular drugs [53]. Moreover, in a chronic disease like glaucoma, assessment of the quality of life has great importance because a poor quality of life directly impacts the negative progress of the disease, resulting in restrictions in daily activities that may extend to blindness [29]. A pharmacist can reduce the incidence of drug-drug interactions by revising the prescribed treatment, detecting interactions, and solving medication-related problems. Pharmaceutical care may positively improve patient's quality of life and the outcomes of the disease through patient education about the proper use of medications, decreasing adverse reactions and drug interactions, and improving patient compliance [43,54].

Conclusion

Many issues arise when treating glaucoma without pharmaceutical care services, such as unpleasant responses, drug-drug interactions, and poor adherence and quality of life. Pharmacists may play a critical role in highlighting DTP, improving patient adherence, mitigating the negative consequences of inappropriate glaucoma prescription use, resolving drug therapy issues, and enhancing quality of life. The lack of pharmacist role has resulted in numerous issues linked with the incorrect use of antiglaucoma medications. As a result, pharmaceutical care is strongly advised for glaucoma sufferers.

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Conflicts of interest

There are no conflicts of interest.

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Data sharing statement

All data are available upon reasonable request to the corresponding author.

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