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Factors Affecting Adherence of Geriatric Patients with Glaucoma to Their Topical Medications

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Abstract: Glaucoma is one of the major causes of irreversible blindness worldwide, with increasing incidence and prevalence among older adults. It needs lifelong treatment in the form of either medical or surgical treatment. The main goal of glaucoma treatment is to lowering intraocular pressure. Despite all effort to improve adherence, the adherence rate in glaucoma considerably low. Failure to adhere to anti-glaucoma treatment may lead to the disease progression and visual loss. This study aimed to identify factors affecting adherence of geriatric patients with glaucoma to their topical medications. Settings: Ophthalmology outpatient clinics of the Alexandria main university hospital (glaucoma clinic). 210 geriatric patients who were diagnosed with primary open angle glaucoma, currently taking intra-ocular pressure lowering medication, who have normal cognitive functions with no depression. Four tools were used for data collection. Results of this study revealed that, there was a positive effect of the marital status, income, place of residence, living arrangement, family history, suffering from chronic disease, commitment to follow up visits, visual acuity and the study subjects' compliance score to topical glaucoma treatment. Conclusion: The main reasons for non-adherence among geriatric patients with glaucoma to their medications were lower education, unmarried, not enough income, living in rural areas, living alone, having chronic diseases, uncommitted to follow up visits and decreased visual acuity. Recommendations: Health education programs should be provided to both health care providers who work in glaucoma outpatient clinics and geriatric patients with glaucoma about the barriers that affecting medication adherence and the recommended solutions for improving their adherence.

Key words: Geriatric Patients · Glaucoma · Adherence · Topical Medications

INTRODUCTION

Glaucoma is a group of disorders that damage the optic nerve of the eye, with increased intra-ocular pressure, that cause progressive loss of vision [1]. According to World Health Organization (WHO) [2], glaucoma is the second worldwide cause of blindness after cataract; that causes irreversible blindness [2]. The most common type of glaucoma is Primary Open Angle Glaucoma (POAG); the gradual loss of vision is the only noticeable sign for it [3].

The prevalence of glaucoma is higher in some subgroups of the population such as the elderly, people with diabetes, hypertension and myopia. POAG affects 70 million people worldwide and it is estimated to affect 111.8 million by 2040 [1]. An Indian study showed that 90% of glaucoma patients remain undiagnosed and it responsible for significant rise of glaucoma blindness [4]. For that reason, early detection, diagnosis and appropriate treatment are crucial [5]. Patients with POAG are likely to require life-long treatment with intra-ocular pressure lowering medications for control of the disease. They also need to be regularly checked for their adherence with the antiglaucoma treatment. The successful medical treatment of glaucoma depends on adherence to a topical medical regimen. Non-adherent patients had higher mean intra-ocular pressure (IOP) and worse loss of visual field [6].

Throughout the literature, compliance and adherence are often used interchangeably. Most health care professionals who are experts in this field prefer the term adherence because compliance indicates a degree of passivity of the patient's part [7]. A practical comment was published by Muir & Lee, who said that; "*adherence*

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to glaucoma medicine, involves four steps, the patient needs to get the medication, he or she has to be physically able to apply the drop in the eye and use the medication at the appropriate time. Lastly, he or she needs to repeat these three steps every day".

In spite of the availability of effective topical glaucoma therapies, the reality is that many patients do not use ocular hypotensive medication in the method prescribed by physicians. Non adherence has been reported in patients with glaucoma to range from 5 to 80% [9]. Adherence to the treatment is a complex behavior and is influenced by many factors. These include discomfort of the eye (e.g., stinging, burning, blurriness), frequency of administration, lack of apparent or immediate symptoms until later stages of the disease (asymptomatic), age, motivation, education, health literacy, forgetfulness, lack of awareness regarding the complications of advanced glaucoma, hearing difficulty, physical or cognitive disability, limited social and financial resources, impaired visual acuity, contrast sensitivity and stereopsis [9-13]. There are several factors accompanied by poor technique of eye drop instillation such as; poor vision, poor manual dexterity, older age and limited education [10, 13]. Many elderly patients have difficulties to instill eye drops due to reduced motor coordination and poor near sight without eyeglasses [6, 14]. Applying the drops in the correct manner is challenging for elderly patients with rheumatic diseases, they are often not able to open medication containing bottles or single use units [15].

Non adherence can be measured directly or indirectly. Direct methods of assessing medication non-adherence discover the presence of the drug in the patient's body using assays for the drug, drug metabolites or other indicators in urine and blood. However, such methods are hardly used because of its high cost. Indirect methods measure medication non-adherence by analyzing behavior. They include pill counts, pharmacy refills, electronic drug monitoring and reviewing of medical records and self-reports. Self-reports have the following advantages: they are brief, inexpensive and applicable in various settings. In addition, they can provide immediate feedback at the point of care and disclose underlying issues that contribute to non-adherence [16].

Recently a special interest has been given to the elderly patient's adherence with topical glaucoma medications [17]. Gerontological nurse has a major role in recognizing poor adherence to medications among glaucoma elderly patients and in addressing multiple potential challenges that interfere with patient's adherence [10, 18]. Addressing the unique challenges of adherence with glaucoma medications requires communication skills, understanding of patient's behavior and using a tailored, patient-centered care approach [10, 12].

Moreover, gerontological nurse has a vital role in improving patient adherence to self-administered medication. This can be done through providing instructions for patients about how to apply the eye drops correctly add reminders, simplify dosing regimens, increase convenience and accessibility to health care, motivation, provide rewards for improvement and counseling and promote patient provider communication [17, 18]. Also, gerontological nurses must focus on educating family members or caregivers, because the elderly patients need someone to remind them to take their medications if they forget it [12].

Aim of the Study: The study aimed to identify factors affecting adherence of geriatric patients with glaucoma to their topical medications.

Research Question:

- What are the factors affecting adherence of geriatric patients with glaucoma to their topical medications?

MATERIALS AND METHOD

Materials

Design: This study followed a descriptive research design.

Setting: The study was carried out at the ophthalmology outpatient clinics of the Alexandria main university hospital (glaucoma clinic). The ophthalmology outpatient clinics serve patients from all age groups in three governorates namely; Alexandria, El Beheira and Matrouh. The working hours of these clinics are from 8 Am to 2 Pm six days per week.

Subjects: All the older adults who attended the glaucoma clinic at the ophthalmology outpatient clinic of the Alexandria main university hospital during a period of three months were recruited conveniently based on the following criteria: aged 60 years and above, have normal cognitive functions (score 24 and more on the Mini Mental State Examination Scale), have no depression (score 4 or less on the Geriatric Depression Scale Short Form), diagnosed with primary open angle glaucoma, currently taking intra-ocular pressure lowering medication, able to communicate and accepted to participate in the study. The sample comprised two hundred and teen (210) elderly patients.

Sample Size: Convenient sample, the estimated sample size was 210 elderly patients, at confidence level 95% and precision rate at 0.05 by using Steven equation, 2012. Since the total number of available elderly patients was 432.

$$n = \frac{N \times p(1-p)}{[N-1 \times (d^2 \div z^2)] + p(1-p)]}$$

while;
P = 0.5
N = Total population
z = Z value "1.96"
d = Standard Error
n = sample size

Tools of Data Collection: Four Tools Were Used to Collect the Data

Tool I: Mini – Mental State Examination (MMSE): This scale was developed by Folstein *et al.* [19]. It was translated into Arabic and approved to be valid and reliable (r = 0.93) by Elokl [20]. The scale is used to assess the older adult's cognitive functions. It consists of 10 items that investigate the memory, orientation to time, person and place, attention, calculation, naming, repetition, registration, language, praxis and copying of a design. The scale consists of 30 questions to which the geriatric patient responds either by (Yes) or (No). A score from 24 to 30 indicates no cognitive impairment, a score from 18 to 23 indicates mild cognitive impairment and a score from 0 to 17 indicates severe cognitive impairment. Tool II: Geriatric Depression Scale Short Form (GDS-SF): This scale was developed by Yesavage *& Sheikh* [21]. It was designed to assess depression and general well-being of older adults. It was translated into Arabic and approved to be valid and reliable (r = 0.80) by El Husseini [22]. It consists of 15 questions to which the geriatric patient responds either by (Yes) or (No) to indicate how he/she has felt over the past week. The maximum score on the scale is 15. A score from 0 to 4 indicates no depression, a score from 5 to 8 indicates mild depression, a score from 9 to 11 indicates moderate depression and a score from 12 to 15 indicates severe depression.

Tool III: Geriatric Patient with Glaucoma Socio - Demographic and Clinical Data Structured Interview Schedule: This tool was developed by the researchers and includes two parts:

Part (1): Geriatric Patient with Glaucoma Socio-Demographic Characteristics: It includes socio-demographic characteristics of the study subjects such as; age, sex, marital status, level of education, income, living arrangements and the place of residence.

Part (2): Geriatric Patient with Glaucoma Clinical Data: It includes the clinical data of the study subjects such as; the onset and the duration of glaucoma, the affected site, the past eye surgeries, presence of other medical diagnosis, treatment regimen and their intraocular pressure reading.

Tool IV: The Glaucoma Treatment Compliance Assessment Tool (GTCAT): It is a new questionnaire designed by Mansberger *et al.* [23] to assess adherence with glaucoma therapy. This scale consists of 47 statements includes items related to the six Health Belief Model. Statements 23, 24, 25, 26, 28, 31, 32, 33 assess barriers of the glaucoma treatment compliance. Statements 9, 20, 38 assess benefits of the glaucoma treatment, while statements 34, 39 assess Cues-to-action. Statements 1, 2, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 46 assess patients' knowledge about glaucoma and statements 15, 43, 47 assess patient-physician relationship. Patients' self-efficacy was assessed by statements 21, 29, 30, 35, 40, 41, 42 while their susceptibility was assessed by statements 19, 27, 36, 37, 44, 45. Severity of the disease was assessed by statements 3, 16, 17, 18 and statement 22 assesses the patients' self-report adherence. Responses to each item were graded on a 5-interval Likert scale with anchoring definitions (e.g.: 1 = absolutely disagree, 5 = absolutely agree). For this study and after analysis of those responses with mean, the researchers considered the mean between (1-1.80) as strongly disagree and those with mean (1.81–2.60) as disagree. Responses with a mean of 2.61–3.40 referred to no opinion/ don't know. The mean of responses of 3.41–4.20 considered as agree and 4.21–5.00 as strongly agree. The minimum score was 47 and the maximum score is 235.

Method:

- Official letter was issued from the Faculty of Nursing, Alexandria University and forwarded to the director of the ophthalmology outpatient clinics of the Alexandria main university hospital to obtain an approval to carry out the study after explanation of the purpose of the study, date and time of data collection.

- Tool III Geriatric patient with glaucoma Socio - demographic and clinical data structured interview schedule was developed by the researchers after a thorough review of relevant literature.
- Tool IV The Glaucoma Treatment Compliance Assessment Tool (GTCAT) was translated into Arabic language by the researchers.
- Tools III and IV were tested for content validity by five (5) experts in the field of the study namely; Gerontological nursing, Geriatric medicine and Ophthalmic medicine.
- The study tool IV was tested for reliability on ten (10) older adults using Cronbach's coefficient alpha reliability method. The reliability result of tool IV was 0.802.
- A pilot study was conducted on a subject equal to 10 % of the total subject size (21 geriatric patients) selected from the outpatient clinics of the Alexandria ophthalmology general hospital (Farouk) to determine the clarity and applicability of the study tools.
- The researchers used to visit the glaucoma clinic at the ophthalmology outpatient clinics of the Alexandria main university hospital at the working hours in two different days each week at morning shift (8 a.m-2p.m) for a period of three months to collect data.
- Geriatric patients who met the inclusion criteria were included conveniently in the study.
- Each geriatric patient was interviewed individually face-to-face at the waiting area for approximately 30 -40 min to complete the study tools.
- Data collection started from the first of May till the end of July 2019.

Ethical Considerations: An informed verbal consent was acquired from every older adult involved in the study after providing appropriate explanations about the purpose of the study. The privacy and anonymity of the participants and confidentiality of the collected data were maintained.

Statistical Analysis: Data collected from the studied sample was revised, coded and entered using Personal Computer (PC). Computerized data entry and statistical analysis were fulfilled using the Statistical Package for Social Sciences (SPSS) version 22. Data were presented using descriptive statistics in the form of frequencies, percentages and Mean SD. ANOVA is a statistical technique that is used to check if the means of more groups are significantly different from each other. T test was used to compare means of two groups. Multiple regression is an extension of simple linear regression. It is used when we want to predict the value of a variable based on the value of two or more other variables.

Significance of the Results:
Highly significant at p-value < 0.01.
Statistically significant was considered at p-value < 0.05
Non-significant at p-value ≥ 0.05

RESULTS

Table (1): shows the distribution of studied elders according to the total mean and mean percent scores of "Glaucoma Treatment and Compliance Assessment tool" and its statements. It reveals that, the total mean percent scores of studied subjects regarding to their knowledge related to glaucoma, perception of the benefits of using glaucoma treatment, perception of severity of their disease (glaucoma), perception of susceptibility to get glaucoma and perceptions of barriers to compliance with glaucoma treatment were 51.43, 52.33, 52.05, 48.36 and 47.08% respectively. Furthermore, it is noticed from the table that, the total mean percent scores of studied subjects regarding to their self-efficacy to compliance with glaucoma treatments, cause-to-action to compliance with glaucoma treatments, self-report adherence with glaucoma treatments and patient's physician relationship were 44.26, 44.2, 36.7 and 47.8 % respectively. Finally, the total mean percent score of Glaucoma Treatment and Compliance Assessment tool was 48.17%.

Fig. (1) indicates that, 69% of studied subjects were non-compliant with glaucoma treatment, while 31% of them were compliant.

Table (2) demonstrates that, there was highly statistically significant relation between total compliance score of studied subjects and their income and living arrangement at P = < 0.01. Also, there was statistically significant relation with their marital status and residence at p= < 0.05. While, there was no statistically significant relation with their age and sex at p= > 0.05.

Table (3) validates that, there was highly statistically significant relation between total compliance score of studied subjects and their family history related glaucoma, suffering from chronic disease, commit to taking the prescribed treatment, commitment to follow up and availability of easy transportation to the place of follow-up at P= < 0.01. While, there was no statistically significant relation with their affected eye, number of medications, medical regimen for glaucoma and number of times daily use of eye drops at p= > 0.05.

Table 1: Distribution of studied elders according to their total mean and mean percent scores of Glaucoma Treatment and Compliance Assessment tool and its statements

Statements	Maximum allowed scores	Mean	Mean%	SD
Total knowledge related to glaucoma: (Statements 1, 2, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 46).	60	30.86	51.43	3.27
Total perception of the benefits of using glaucoma treatment: (Statements 9, 20, 38).	15	7.85	52.33	2.41
Total perception of severity of their disease (glaucoma): (Statements 3, 16, 17, 18).	20	10.41	52.05	2.75
Total perception of susceptibility to get glaucoma: (Statements 19, 27, 36, 37, 44, 45).	30	14.51	48.36	4.3
Total perceptions of barriers to compliance with glaucoma treatment: (Statements 23, 24, 25, 26, 28, 31, 32, 33).	40	18.83	47.08	5.72
Total self-efficacy to compliance with glaucoma treatments: (Statements 21, 29, 30, 35, 40, 41, 42).	35	15.49	44.26	4.66
Total Cause-to-action to compliance with glaucoma treatments: (Statements 34, 39).	10	4.42	44.2	1.33
Total Self report adherence with glaucoma treatments: (Statement 22).	10	3.67	36.7	0.91
Total Patients physician relationship: (Statements 15, 43, 47).	15	7.17	47.8	1.64
Total scale	235	113.21	48.17	26.99

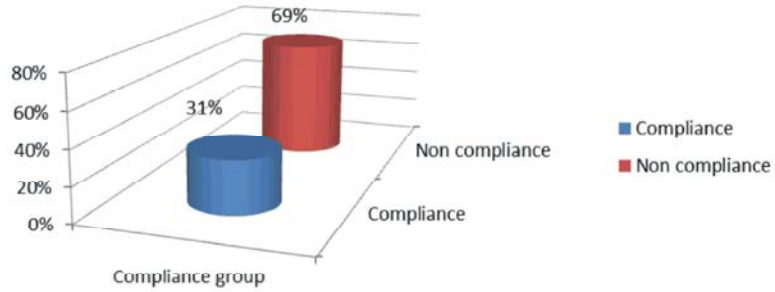

Fig. 1: Percentage distribution of studied Elders related to their compliance levels (N = 210)

Table 2: Relation between studied subjects' characteristics and their compliance score (n=210)

Items	No (n=210)	%	Mean compliance score	Test	P value
Age (year)					
Young – old (60 < 75)	85	40.5	117.94±16.65	Anova 1.005	.063
Middle – old (75 < 85)	110	52.4	116.54±15.47		
Old – old (≥ 85)	15	7.1	118.01±16.00		
Sex					
Male	90	42.9	114.80±21.02	T. test 1.032	.058
Female	120	57.1	115.71±17.61		
Education level					
Illiterate	16	7.6	109.64±17.48	Anova 4.264	.013*
Read and write	42	20	111.78±20.30		
Basic	112	53.3	118.00±19.44		
Secondary	34	16.2	123.55±18.07		
High	6	2.9	129.64±16.37		
Marital status					
Married	116	55.2	119.22±24.16	Anova 3.008	.023*
Divorced	20	9.5	116.35±19.33		
Widow	74	35.3	115.00±18.47		
Income					
Enough	56	26.7	119.56±20.68	T. test 6.512	.008**
Not enough	154	73.3	108.47±18.05		
Residence					
Urban	121	57.6	112.03±17.47	T. test 4.105	.011*
Rural	89	42.4	107.22±19.03		
Living arrangement					
With spouse	64	30.5	119.40±18.22	Anova 7.105	.003**
With family(spouse, children)	106	50.5	121.86±20.06		
Alone	21	10.0	106.42±14.01		
Geriatric home	19	9.0	113.84±13.64		

*Significant at p ‹0.05. **Highly significant at p ‹0.01. Not significant at p>0.05

Table 3: Relation between studied subjects' health profile and their compliance score (n=210)

Items	No (n=210)	%	Mean compliance score	Test	P value
Affected eye					
Right	117	55.7	115.46±24.6	Anova 1.964	.061
Left	67	31.9	113.02±19.30		
Both	26	12.4	114.05±20.16		
Family history related glaucoma					
Yes	59	18.1	121.32±19.06	T. test 7.018	.001**
No	151	71.9	112.80±20.28		
Others chronic disease					
Yes	172	81.9	106.33±14.02	T. test 5.069	.006**
No	38	18.1	118.61±16.92		
Number of medications related chronic disease (N=172)					
One	41	23.8	115.21±19.30	Anova 0.864	.304
Two	102	59.3	117.34±15.77		
Three or more	29	16.9	116.01±14.75		
Medical regimen for glaucoma#					
Drops or ointments	210	100.0	116.03±18.46	Anova 0.961	.241
Tablets	124	59.1	114.28±16.39		
Popular natural recipes	32	15.2	114.31±17.70		
Number of times daily use of eye drops					
Once	62	29.5	112.36±17.62	Anova 1.645	.051
Twice	119	56.7	114.08±15.99		
Three times	39	18.6	115.00±18.03		
Commit to taking the prescribed treatment					
Yes	61	29.1	123.61±26.00	T test 7.001	.002**
No	149	70.9	115.02±19.47		
Commitment to follow up					
Yes	54	25.7	124.38±17.76	T test 5.291	.007**
No	156	74.3	116.84±19.47		
Financial problem related uncommitted to follow up					
Yes	135	64.3	110.59±22.02	T test 2.918	.031*
No	75	35.7	114.08±18.34		
Availability of easy transportation to the place of follow-up					
Yes	47	22.3	120.84±19.9	T test 6.039	.004**
No	163	77.7	112.00±15.06		

*Significant at p ‹0.05. **Highly significant at p ‹0.01. Not significant at p>0.05
More than one answer.

Table 4: Multiple Linear regression model

	Unstandardized Coefficients	Standardized Coefficients		
Items	*B*	B	T	P. value
Marital status	.118	.169	1.038	.031*
Income	.208	.160	2.801	.041*
Residence	.136	.106	3.602	.012*
Living arrangement	.253	.189	4.030	.010*
Family history	.198	.191	2.368	.021*
Others chronic disease	-.244	.217	3.525	.016*
Commit to taking the prescribed treatment	.163	.150	9.381	.003**
Commitment to follow up	.174	.165	7.520	.000**
Financial problem related uncommitted to follow	-.155	.152	2.908	.03*
Easy transportation to the place of follow-up	.179	.168	6.611	.000**
Visual acuity RT	.230	.199	5.371	.001**
Visual acuity LT	.201	.186	4.990	.003**
Eye pressure RT	.087	.063	1.055	.067
Eye pressure LT	.064	.047	1.002	.080
	ANOVA			
Model	Df.	F		P. value
Regression	10	6.102		.003**

a. Dependent Variable: Compliance score
b. Predictors: (constant) Marital status, Income, Residence, Living arrangement, Family history, Other chronic diseases, Commit to taking the prescribed treatment, Commitment to follow up, Financial problem related uncommitted to follow, Easy transportation to the place of follow-up, Visual acuity and Eye pressure

Table (4) reveals that, there was highly significant positive effect of commitment to taking the prescribed treatment, commitment to follow up, easy transportation to the place of follow-up and visual acuity on total subjects' compliance score at p = < 0.01. Also, there was significant statistical positive effect of marital status, income, residence, living arrangement, family history, suffering from chronic disease and financial problem related uncommitted to follow on total subjects' compliance score at p = < 0.05, but there was no effect of eye pressure on their compliance score at p >0.05.

DISCUSSION

Glaucoma is one of main causes for irreversible blindness all over the world. Glaucoma, as many other chronic diseases, has a low adherence and persistence rate which may cause a progression of the disease and later increased the dependency of older adults [1, 24]. There are multiple barriers of adherence inseparable to the glaucoma elderly patient populations. Although most of these barriers are common in the elderly (e.g. reduced cognition, musculoskeletal problems and transportation difficulties), other expected obstacles, such as disease severity, medication cost, limited health insurance and role of complicated dosing regimens are prevailing. Poor adherence also accompanied with decreased adherence to follow up medical visits. Addressing these specific barriers will necessitate a tailored, patient-centered approach [12].

The present study used the Glaucoma Treatment Compliance Assessment Tool (GTCAT) to assess adherence with glaucoma therapy. Almost half of the subjects reported total agreement level related to their knowledge regarding to glaucoma (Table 1). Al -Hasanat study [25], which was done in Palestine 2017 using the same tool, did not agree with the present study and reported that more than two thirds of the study subjects having total agreement level related to their knowledge. It may be related to the difference in the level of education of the studied subject in both studies. Regarding the total agreement level related to their perception for the level of their disease severity, the present study revealed that, the Egyptian studied subjects perceived severity of the disease with higher percent than the Palestinian population. This may be related to the difference in the level of the visual acuity of the studied subjects in both studies. The present study subjects reported higher level of total agreement related to their perception for the benefits of using treatment than the study subjects of Al- Hasanat [25]. It may be related to the higher percent of perceived severity of the disease which may bring more hope for treatment.

Regarding the total perceptions of barriers to compliance with glaucoma treatment, nearly half of the study subjects reported total agreement level to their perception of treatment barriers comparing to only one third in Al-Hasanat [25]. Nearly same result was observed in both studies related to the total agreement level related to their perception of cues-to-action. Also, the same responses were found between both studied subjects regarding total agreement level related to their perception of self-report of compliance with glaucoma treatment. Regarding the total agreement level related to their perception of patient- physician relationship, the present study subjects reported higher percent than the Al-Hasanat [25]. This can be justified as the higher percent of decreased visual acuity of the present study subjects, which make the physician more cautious when dealing with these patients to prevent further visual loss.

Poor compliance with treatment is known to influence glaucoma progression. Diseases like glaucoma that are a symptomatic are more prone to poor patient compliance [26]. The result of the present study revealed that, almost two thirds of the study subjects reported non- compliance to glaucoma treatment. The study of Al-Hasanat [25] came in congruent with the present study and revealed that more than two thirds of the respondents reported non-compliant to topical anti-glaucoma treatments. Also, a study of Gadkari &McHomy, [27] in USA reported similar result and revealed that the majority of the participants reported at least one of the three unintentional non-adherence behaviors in the past six months. Nearly similar result was reported by the study of Abu Hussein *et al.* [26] in Egypt, which revealed that, almost half of the glaucoma patients were non-compliant to their medication. Another study of Weiss *et al.* [28] reported contradicting finding as it revealed much higher compliance rate 80.3% of glaucoma patients to their medications.

Thus, geriatric patient characteristics including socio-demographic criteria such as age, gender, marital status and level of education appear to have a direct impact on eye-drop treatment compliance [29]. The present results revealed that, while the level of compliance to glaucoma medication improved with increased age, yet there is no statistically significant relation was found between them. This may be related to that, the

studied subjects who aged 85 years and more were the least percent 7.1% than the young old and middle old. This finding is in agreement with a study of Al-Hasanat [25]. A study done by Abu Hussein *et al.* [26] in Egypt contradicted this finding, which reported that higher non-compliance was found in elderly patients and increased age associated with increased risk of non-compliance. Also, a study of Regnault *et al.* [3], which done in France contradicted the present finding and revealed that a statistically significant difference in the treatment compliance score according to age group, with lower score for patients older than 72 years.

Regarding the relation between studied subjects' sex and their compliance score, it was observed that while the total score of treatment compliance was higher in the female geriatric patients than male, yet there is no statistically significant relation was found. This result can be justified as; the proportions are close between both sexes. The same result was found in the Al-Hasanat [25]. There are two studies contradicted the present finding, one of them reported that their female patients showed significantly higher adherence to anti-glaucoma medication [26] and the second study revealed that the non-compliant patients are more often men with a statistically significant difference [29].

As regard the relation between level of education of the studied subjects and their compliance score, the present study revealed that there is a statistically significantly difference between them, the higher the level of education, the higher the compliance score of geriatric patients. The study of Abu Hussein *et al.* [26] confirmed the present finding and found that there is a statistically and highly significant difference in compliance between educated and non-educated patients, with the highest percentage of non-compliance patients falling in the non-educated (illiterate) group. Also, study of Nordmann *et al.* [29] agrees with the present study and reported direct impact of geriatric patients' educational level and their eye drop treatment compliance. In contrast to the present study, the Al-Hasanat [25] revealed that, there was no significant difference between compliance to topical glaucoma medication with respect to their educational level. Educational level seems to affect patient's adherence to glaucoma medication, may be because of apparent difficulties in understanding the prescribed regimen. Also, the patients with higher level of education may have awareness of the severity of the disease and seek more advice and take more knowledge.

As for the relation between the marital status of the present study subjects and their compliance score, it was observed that there is a statistically significant relation between them. In other words, the married subjects have higher percent of compliance score than unmarried group. This finding is consistent with that of Nordmann *et al.* [29] who reported that the marital status appears to have a direct impact on eye drop treatment compliance. On the other hand, the Al- Hasanat [25] contradicted this finding and reported that there is no significant difference in the glaucoma patient's compliance to topical glaucoma with respect to their marital status. The marital status seems to be an important factor in compliance, the presence of a partner is considered a motivating factor for patients, either as a reminder or as a direct participant who would administer eye-drops. Regarding the effect of living arrangement of the studied subjects and their compliance score, it was observed from the present study that there is a highly statistically significant relation found between them. The geriatric patient who lives with their families and spouses showed higher score of compliance. The same finding was found in the Cook *et al.* [30] in USA study who reported that, motivation and social support were strongest predictors of adherence. This result confirmed the result presented earlier in the marital status.

The cost of the medication regarding the monthly patient's income is an important factor and can lead to a reduced adherence if the patient cannot bear the expense of the medication prescribed [31]. The income of the present study subjects has a highly significant effect on their compliance score. The geriatric patients with sufficient income have higher compliance score than those with insufficient income. This may be related to the characteristics of the study setting; as the out-patient clinics of the main university hospital usually serve patients with no health insurance coverage and the financial coverage of cost of the prescribed therapy is the responsibility of the patient. The same finding was found by the Gadkari & McHomy, [27] who reported that skipping doses to make medication last longer was the most commonly reported intentional non- adherence behaviors followed by taking smaller doses to make medication last longer and all these behaviors resulted from insufficient patient's income. The result of Al- Hasanat [25] came incongruent with the present study and revealed that there is no significant difference of glaucoma patient's level of compliance to topical glaucoma and their household income.

The present study result revealed that urban geriatric patients with glaucoma have better level of compliance score than those living in rural areas and the difference is statistically significant. This is congruent with the result of the study done by Alemu *et al.* [32] in Ethiopia, who reported higher level of awareness and knowledge about glaucoma among urban communities, therefore that those populations have higher level of compliance to their glaucoma medication. In addition to that, the rural geriatric patients may have not easy access to a specialized public hospital to examine, diagnose and treating their eye problems. The result of Al Hasanat [25] contradicted the present finding and reported that there was no significant difference between compliance of the patients to their topical glaucoma and their address/location.

Regarding the relation between health profile of the studied subjects and their compliance score, it was observed that there was highly statistically significant relation between total compliance score of the studied subjects and their family history related to glaucoma. This can be justified again to a better compliance with knowledge about the disease that is gained from family. The study of Abu Hussein *et al.* [26] in Egypt, comes in the line with the present study and reported that, there is highly significant difference in compliance in the patients having a positive family history of glaucoma. Al Hasanat [25] contradicted the present finding and revealed that there was no significant difference between patient's past family history of glaucoma and their compliance.

Regarding the relation between suffering from other chronic diseases and total compliance score among the studied subjects, it was found that there is a highly statistically significant relation between them. The patients with no other chronic diseases have higher compliance score than the group with multiple chronic diseases. This can be justified as geriatric patients with multiple comorbidities have a complicated treatment schedule that can affect their level of compliance, in addition to the associated burden of those comorbidities that may lower the patients' compliance especially if it affected their manual dexterity, coordination, comprehension, or memory. The same result was found in the Abu Hussein *et al.* [26] who reported that systemic comorbidity had a statistically significant association with compliance. In contrast to the present study, Al Hasanat [25] revealed that, there was no significant difference between systemic comorbidity and compliance to topical glaucoma treatment.

The present study revealed that, there are no statistically significant relations between the numbers of medications taken by the studied subjects; medical regimen for glaucoma, number of times daily use of eye drops and their compliance score. Abu Hussein *et al.* [26] Egypt came in the same line with the present study and reported low significant statistically (P= 0.066). Also, Al Hasanat [25] agreed with the present study in the relation between frequency of eye drops and compliance score of the study subjects, it was reported that there was no significant relations between them, while it contradicted the present study in the relation between number of eye glaucoma and compliance score which revealed the presence of significant relation between them among study subjects. Tsai [12] in USA disagreed with the present study and revealed that, patients started on multiple glaucoma medications were more adherent than those started on a single medication. Also, it revealed that complicated dosing regimens increase the risk of non-adherence. A study of Robin *et al.*[33] in USA also contradicted the present study and concluded that, the addition of a second medicine to patients' medications having a consequent decrease in their adherence.

Regarding the relation between commitment to follow up visits and the compliance score of the studied subjects to glaucoma treatment, it was found that there is a statistically significant relation between them. The study subjects who commit to follow up visits reported higher mean compliance score than others. Most of the study subjects reported their financial problem as the underlying cause of their uncommitted to follow up visits and it was found that, there is a statistically significant relation between financial problem and their compliance score. Also, the study subjects reported that, uneasy transportation to the place of follow up may be a cause of un-commitment to follow up visits with a statistically significant difference. The same result was found in Al Hasanat [25] and reported that, problems in access to transportation had significant effect on compliance to topical anti-glaucoma treatments. Also, Gurwitz *et al.* [34] reported that, within a 1-year study, noncompliance is most strongly related to < 2 visits, with an ophthalmologist. The study of Abu Hussein *et al.* [26] Egypt confirmed the result of the present study and reported that, the non-compliance to medication was found to be associated poor compliance to follow up visits. Tsai [12] reported the same result and found that; non-adherence to follow up visit schedules was associated strongly with the lack of the use of glaucoma medication.

The present study revealed that, there is a highly significant positive effect of visual acuity on both eyes on total subjects' compliance score. Geriatric patient with adequate visual acuity seems to be able to read and follow

the drug instructions and use of eye drop correctly than those with poor visual acuity. On the other hand, the present study revealed that, there is no effect of intraocular pressure on their compliance score. The study of Al Hasanat [25] agreed with the present result and confirmed that, there was no significant correlation between degree of compliance and two most recent intraocular pressure results and contradicted the present study in the relation between level of visual acuity and degree of compliance. It was found that there was no significant difference between patients' level of visual acuity and their compliance to topical glaucoma.

CONCLUSION

It can be concluded from the findings of the present study that, geriatric patients with glaucoma who are highly educated, married, with enough income, reside in urban areas, living with family, have positive family history to glaucoma, with no chronic diseases and better visual acuity, commit to prescribed treatment and follow up visits have better compliance score to their topical glaucoma treatment than others.

Recommendations: Based on the findings of the present study, it can be recommended that:

- Nursing assessment of geriatric patients' adherence to topical glaucoma medications should be an integral part of the comprehensive assessment of these patients.
- Establishing and utilizing a health educational program about glaucoma and its treatment for all newly diagnosed geriatric patients.
- Developing a simplified illustrated and comprehensive Arabic brochures or flayers including information related to glaucoma and the importance of adherence to its medical treatment to be distributed to geriatric patients in glaucoma outpatient clinics.
- In service education program should be planned and implemented to the health care providers in glaucoma health care settings about the possible factors/ causes of non-adherence among geriatric patients with glaucoma to solve any problems and eliminate any barriers.

Further Research Recommended:

- Plan and implement health education program for geriatric patients with glaucoma to improve their adherence to their topical glaucoma medication.

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