

Associating factors of insomnia and depression in Glaucoma: A Descriptive analysis

Dr. Akhilesh Jain¹, Dr. Rekha Sharma², Dr. Ashok Goyal^{3§}, Dr. Neelam Yadav⁴,
Dr. Garima Jain⁵, Dr. Mukesh M⁶

¹Head of Psychiatry Department, Model ESIC Model Hospital, Jaipur (Rajasthan) India

^{2,3,4,5,6}Medical Officer, Model ESIC Model Hospital, Jaipur (Rajasthan) India

[§]Corresponding author's Email: ashokgoyal_dr@yahoo.com

Abstract—*The role of emotional factors in glaucoma has received wide recognition by investigators and clinicians from the very beginning. Prevalence of depression in glaucoma has been estimated to be 10 to 12 percent in previous studies. Insomnia is another psychiatric co-morbidity reported with glaucoma. Both depression and insomnia in glaucoma patients may significantly affect overall quality of life in these patients adversely. The present study explores the predictive factors of insomnia and depression in patients with Glaucoma. A case-series type of observational study was carried out on 100 glaucoma cases attended at ESIC Model Hospital, Jaipur (Rajasthan) India. The PHQ -9 and ISI were used to assess depression and insomnia respectively. Data in details were collected as per pre-designed Performa. Data collected were analyzed and inferred with chi-square test. Insomnia and depression was found in 37% and 36% respectively in glaucoma cases. Insomnia and depression both were found associated with Age, Visual acuity in both the eyes and severity of glaucoma. No other studied socio-demographic and disease variables had significant association with either insomnia or depression. It was concluded that insomnia and depression are commonly found with glaucoma. Both insomnia and depression were found significantly more in older agr group, less visual acuity and sever glaucoma than their counterparts.*

Keywords: *Insomnia, Depression, Glaucoma, PHQ -9, Insomnia Severity Index (ISI).*

I. INTRODUCTION

Glaucoma is a chronic, progressive, and irreversible disease which can result in severe visual disability.¹

The role of emotional factors in glaucoma has received wide recognition by investigators and clinicians from the very beginning. Glaucoma probably more than any other eye disease has been considered to be a psychosomatic disorder. Physical illnesses also create psychological squeal that precipitate psychiatric disorders severe enough to require independent attention. It has been postulated that mental health may impact clinical factors such as glaucoma medication adherence and persistence.^{2,3}

Prevalence of depression in glaucoma has been estimated to be 10 to 12 percent in previous studies.^{4,5} However, in severe glaucomatous disease, the prevalence of depression has been reported to be as high as 32.1%.⁶

Furthermore, depression has been correlated with patient's perception of vision.⁷ However, in contrast to subjective measures of visual perception, objective measures of function such as visual acuity or visual field results have not been linked to glaucoma diagnosis or depression severity.^{6,7} Insomnia is another psychiatric co-morbidity reported with glaucoma.⁸

Both depression and insomnia in glaucoma patients may significantly affect overall quality of life in these patients adversely.

In order to prevent and treat these psychiatric co-morbidity that develop with glaucoma, it is also important to find out the associating factors of these psychiatric co-morbidity. Hence this present study was planned to identify these determinants of these psychiatric co-morbidity in glaucoma.

II. METHODOLOGY

A hospital based case series type of observational study was carried out as joint venture of Department of Psychiatry and Department of Ophthalmology in ESIC Model Hospital, Jaipur, India which is a multi-specialty referral centre in capital of Rajasthan. This hospital caters larger population from each corner of the state.

Among glaucoma cases attended either at outpatient department or ward during 1st Jan. 2013 to 30th June 2013 was recruited for this study. Hindi speaking adult patients (18 -88 years) with glaucoma from more than 6 months prior to enrollment was included in the study. Glaucoma was diagnosed based on glaucomatous disc cupping and reproducible visual field damage in one or both eyes. Patients with primary open-angle glaucoma (POAG), normal tension glaucoma (NTG), primary -closure glaucoma (PACG) and secondary glaucoma (SG) were included in the study. Out of these identified cases, cases with present or past history of major psychiatric illness, current use of any medication which may result in psychiatric manifestations (systemic use of beta blockers), incisional eye surgery within the previous three months or laser treatment within the previous one month, disability in visual field testing due to causes other than glaucoma (e.g., cognitive impairment) and other severe vision-impaired eye diseases (e.g., cataracts (Lens Opacities Classification System III grade 2 or more and age-related macular degeneration) were excluded.

Finally Hundred patients with glaucoma i.e. 50 males and 50 females were recruited. After tacking written informed consent 100 eligible subjects were enterogated as per pre-designed performa to incorporate socio-demographic details and disease characteristics. All participants underwent comprehensive ophthalmic examinations and evaluated for glaucoma symptoms like pain, congestion etc. Anterior chamber depth was examined by slit lamp, and visual aquity by refraction unit. Detailed fundus examination was also done and cup disc ratio was calculated. Automated static perimerty (Humphrey visual field analyzer 30-2) was used to detect peripheral visual field defects and gonioscopy was done to find status of angle (open or closed). Patients were categorized as mild, moderate and severe depending on the results of status of cup and fields. Insomnia Severity Index (ISI) and PHQ-9 were applied to detect Insomnia and depression respectively.

Depression was assessed by administering the nine-item PHQ-9, a self-report version of PRIME-MD11 which assesses the presence of major depressive disorder using modified Diagnostic and Statistical Manual, Fourth edition (DSM-IV) criteria.^{9,10} There is good agreement reported between the PHQ diagnosis and those of independent psychiatry health professionals (for the diagnosis of any one or more PHQ disorder, kappa = 0.65; overall accuracy, 85%; sensitivity, 75%; specificity, 90%). In this study Hindi version of PHQ-9 was used. It has been validated in Indian population and is considered to be reliable tool for diagnosis of depression. The PHQ-9 is a dual instrument that is used to establish a provisional depressive disorder as well as it provides a symptoms severity score. For the diagnosis of depression, clinical significant depression was defined as: a PHQ-9 score of 8–9 as minor depression, a PHQ-9 score of 10-14 as moderate depression; a score of 15 or more and one of the two cardinal

symptoms (either depressed mood or anhedonia) as definite major depression. In this study, PHQ 9 score of 10 or more was accepted as depression.

Insomnia was assessed on Insomnia Severity Index (ISI).¹¹ ISI is one of the most commonly used disease-specific measures for self-perceived insomnia severity. The ISI has 7 items describing insomnia-related health impairments.

Each item is rated on a 5-point Likert scale with scores ranging from 0 to 4, indicating “none”, “mild”, “moderate”, “severe” and “very severe” sleep problems, respectively. The total ISI score is calculated by summing the scores from the 7 items, and range from a minimum of 0 to a maximum of 28, with higher scores reflecting more severe sleep problems. In clinical assessments, the ISI total summary score falls into 1 of 4 ISI categories; with scores 0–7, 8–14, 15–21, and 22–28 indicating no clinically significant insomnia, sub-threshold insomnia, moderate insomnia and, clinically severe insomnia, respectively. The psychometric properties of the ISI have been evaluated in earlier studies and have been reported to have sound measurement quality for measuring perceived insomnia severity and the impact of insomnia in different populations.¹²

Hindi version of the Insomnia Severity Index¹³ was used in this study, which has a reliability of 0.91 and a corrected item correlation range of 0.56–0.87. Hindi version of the Insomnia Severity Index is a valid and reliable tool for the measurement of severity of insomnia.

Statistical analysis: All data collected were entered into Microsoft excel 2007 worksheet in the form of master chart. These data were classified and analysed. Both descriptive and inferential statistics were inferred with the help of MS Excel 2007 and Primer (version 6) statistical software. The data on sample characteristics described in terms of percentage and proportions in the form of tables and graphs whenever it was applicable. To find out difference in proportion 'Chi square test' was used. For significance 'p' value 0.05 or less was considered significant.

III. RESULTS

Out of total 100 eligible glaucoma cases studied with assigned scales to identify psychiatric comorbidity, it was observed that insomnia and depression was found in 37%, and 36% of glaucoma cases respectively. (Figure 1&2)

Figure 1

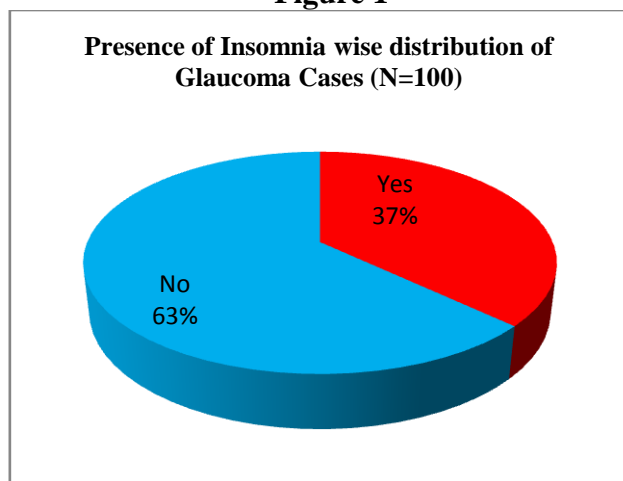
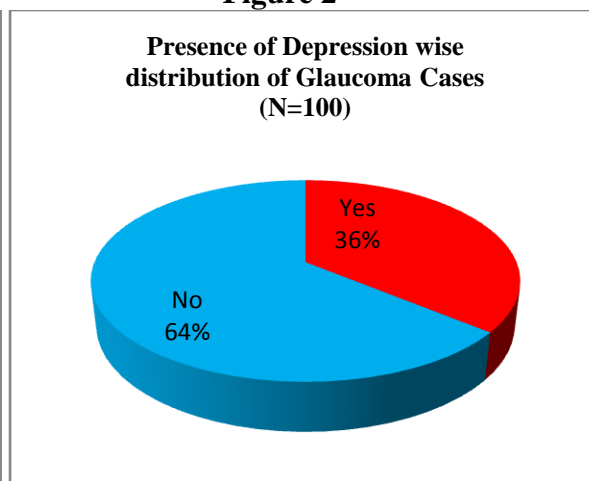


Figure 2



Various Socio-demographic variables studied in this study were age, sex, marital status and Income. Male and Female ratio was kept 1:1 in this study. Maximum participants were from the age group 50 to 70 years (58%) and 95 % were married. 34% participants were having their monthly income between 5000 to 10000 rupees while only 4% had more than 15000 rupees per month. (Table 1)

Table 1
Socio-demographic characteristics of study population (N=100)

S. No.	Socio-demographic Variables		Number	Percent (%)
1	Age (in Years)	<30	6	6
		30-50	29	29
		51-70	58	58
		>70	7	7
2	Sex	Males	50	50
		Females	50	50
3	Marital Status	Married	95	95
		Unmarried	5	5
4	Income Rs/month	<5000	59	59
		5000-10000	34	34
		10,001-15,000	3	3
		>15000	4	4

It was found that none of the socio-demographic variable was associated significantly with Insomnia except age. Insomnia was found to be statistically significant with growing age ($p = 0.013$). (Table 2)

Table 2
Association of Socio-demographic variables with Insomnia in Glaucoma cases (N=100)

S. No.	Socio-demographic Variables		Total No. of cases	Insomnia Status (N=37)		Chi square Test P Value LS
				Present	Absent	
1	Age (in Years)	<30	6	0	6	11.252 at 3 DF 0.013 S
		30-50	29	6	23	
		51-70	58	29	29	
		>70	7	2	5	
2	Sex	Males	50	17	33	0.172 1 DF 0.679 NS
		Females	50	20	30	
3	Marital Status	Married	95	36	59	0.111 1 DF 0.739 NS
		Unmarried	5	1	4	
4	Income Rs/month	<5000	59	27	32	6.895 3 DF 0.099 NS
		5000-10000	34	10	24	
		10,001-15,000	3	0	3	
		>15000	4	0	4	

Similarly, Depression was also not found to have significant association with socio-demographic variables except with age. Depression was found significantly more with increasing age was significant ($p = 0.014$.) (Table 3)

Table 3
Association of Socio-demographic variables with depression in Glaucoma cases (N=100)

S. No.	Socio-demographic Variables		Total No. of cases	Depression Status (N=36)		Chi square Test P Value LS
				Present	Absent	
1	Age (in Years)	<30	6	1	5	11.117 at 3 DF 0.014 S
		30-50	29	4	25	
		51-70	58	28	30	
		>70	7	3	4	
2	Sex	Males	50	15	35	1.085 1 DF 0.285 NS
		Females	50	21	29	
3	Marital Status	Married	95	34	61	0.082 1 DF 0.774 NS
		Unmarried	5	2	3	
4	Income Rs/month	<5000	59	23	36	2.446 3 DF 0.649 NS
		5000-10000	34	12	22	
		10,001-15,000	3	1	2	
		>15000	4	0	4	

Regarding symptomatology of glaucoma cases, pain was found in 66% of cases, congestion in 23%, pupillary reaction in 53%, anterior chamber depth shallow in 28%, visual acuity 6/60 or less in right eye in 37% and in left eye 28%. When association of psychiatric co-morbidity with symptomatology of glaucoma cases was observed it was found that insomnia was found significantly more in participants having visual acuity 6/60 or less in right eye (54.1% v/s 26.9%, P=0.018) as well as in left eye (57.1% v/s 29.1%, P= 0.018). (Table 4).

Table 4
Association of Socio-demographic variables with Insomnia in Glaucoma cases (N=100)

S. No.	Socio-demographic Variables		Total No. of cases	Insomnia Status (N=37)		Chi square Test P Value LS
				Present	Absent	
1	Pain	Yes	34	15	19	0.705 1 DF 0.401 NS
		No	66	22	44	
2	Congestion	Yes	23	9	14	0.009 1 DF 0.996 NS
		No	77	28	49	
3	Pupillary Reaction	Yes	53	24	29	2.606 1 DF 0.106 NS
		No	47	13	34	
4	Anterior Chamber Depth	Normal	72	27	45	2.004 1 DF 0.949 NS
		Shallow	28	10	18	
5	Visual Acuity (RE)	6/60 or less	37	20	17	5.622 1 DF 0.018 S
		6/30 or more	63	17	46	
6	Visual Acuity (LE)	6/60 or less	28	16	12	5.622 1 DF 0.018 S
		6/30 or more	72	21	51	
7	Type of Glaucoma	Open	75	26	49	0.358 1 DF 0.550 NS
		Closed	25	11	14	
8	Duration of Glaucoma (In Months)	6-9	19	3	16	5.279 4 DF 0.260 NS
		9-12	7	3	4	
		12-18	7	2	5	
		18-24	13	5	8	
		>24	54	24	30	
9	Severity of Glaucoma	Mild	34	4	30	16.602 2 DF <0.001 S
		Moderate	42	18	24	
		Sever	24	15	9	

Likewise, depression was found to be significantly associated with visual acuity 6/60 or less in both eyes (P<0.05). Depression was found significantly more with lesser vision. (Table 5)

It was also revealed that more the severity of glaucoma significantly more the probability of depression ($p < 0.001$). (Table 5)

Among all glaucoma cases of present study, 75% were open angle and 25% were closed angle glaucoma. Majority of cases (54%) had more than 24 month's duration. Further, 34% cases were mild, 42% moderate and 24% severe cases of glaucoma. (Table 4 & 5)

On application of Chi Square test, depression and insomnia were significantly associated with severity of Glaucoma ($p < 0.05$), however association of insomnia and depression with type of glaucoma and duration of glaucoma were not found significant. (Table 4 & 5)

Table 5
Association of Socio-demographic variables with Depression in Glaucoma cases (N=100)

S. No.	Socio-demographic Variables		Total No. of cases	Depression Status (N=36)		Chi square Test P Value LS
				Present	Absent	
1	Pain	Yes	34	16	18	2.050 1 DF 0.152 NS
		No	66	20	46	
2	Congestion	Yes	23	8	15	0.012 1 DF 0.913 NS
		No	77	28	49	
3	Pupillary Reaction	Yes	53	22	31	1.020 1 DF 0.312 NS
		No	47	14	33	
4	Anterior Chamber Depth	Normal	72	25	47	0.038 1 DF 0.084 NS
		Shallow	28	11	17	
5	Visual Acuity (RE)	6/60 or less	37	21	16	4.420 1 DF 0.036 S
		6/30 or more	63	15	48	
6	Visual Acuity (LE)	6/60 or less	28	15	13	4.206 1 DF 0.040 S
		6/30 or more	72	21	51	
7	Type of Glaucoma	Open	75	15	60	0.521 1 DF 0.470 NS
		Closed	25	11	14	
8	Duration of Glaucoma (In Months)	6-9	19	4	15	3.693 4 DF 0.448 NS
		9-12	7	3	4	
		12-18	7	4	3	
		18-24	13	4	9	
		>24	54	21	33	
9	Severity of Glaucoma	Mild	34	5	29	23.000 2 DF <0.001 S
		Moderate	42	13	29	
		Sever	24	18	6	

IV. DISCUSSION

The prevalence of insomnia and depression in this study was found 37% and 36% respectively. Almost similar observations were made by other authors. Mabuchi F et. al and Wang SY et. al reported that glaucoma is a significant predictor of depression.^{4,14} Another study conducted in Greece showed that the anxiety and depression levels were significantly higher in patients of primary open angle glaucoma(POAG) than those in healthy controls.¹⁵ Reduced participation in activities of daily living, less social and recreational activities, impaired performance at work may be implicated as some of the plausible explanation for high prevalence of depression in glaucoma patients. Seixas, Azizi, et al.¹⁶ observed a significant association between visual impairment and insomnia symptoms in their study sample of 307 patients with almost 62 percent of patients reporting insomnia symptoms. Furthermore, a high prevalence of sleep disorders, such as insomnia, daytime sleep, sleep apnea can be found in patients with glaucoma.¹⁷

Waller EA et. al (2008) observed that individuals with visual impairment are at risk for sleep disturbances and sleep-disordered breathing.¹⁸ Other authors also found that patients with glaucoma are at risk for obstructive sleep apnea (OSA).^{19,20} Dhillon S et. al (2007) reported that Glaucoma is associated with sleep-disordered breathing and circadian rhythm disruptions.²¹

Recent studies have shown that sleep problems, due to visual impairment can lead to more debilitating conditions (e.g., delayed or advanced sleep-phase syndrome and irregular sleep-wake cycles), which can lead to insomnia and circadian rhythm disorders.²²

Amongst the socio demographic variables, age was found to associate with insomnia and depression in this study population. Insomnia and depression both were found significantly more in older age group in this study population.

Mabuchi et. al⁴ in his study also have found significant association between depression and older age. Skalicky and Goldberg⁶ used Geriatric Depression Scale-15 questionnaire and reported that older age was a risk factor for depression in glaucoma patients. Chronicity of the illness, risk of blindness and various treatment challenges faced by elderly age group who are otherwise also compromised in terms of general debility and other physical problems may have been responsible for this association between old age and depression.²³

Wang H et. al²⁴ in his study have found that global sleep quality decreased with age in both healthy controls and POAG patients. With increasing age, the density of the lens increases thereby reducing light transmission, particularly for the short wavelength (blue) light to which the circadian system has been shown to be most sensitive.²⁵

On the other hand, the occurrence of circadian timing disturbances with age may also be due to neurodegenerative changes in the SCN which may cause decreased regulation function of the non-image-forming system.²⁶

While analyzing clinical in this study, variables insomnia and depression were found associated with visual acuity in either of the eyes and severity of glaucoma regardless of the type of glaucoma.

Association between severity of visual field defect with depression has been reported earlier by Mabuchi,²⁷ Skalicky and Goldberg⁶ also reported that depression was more prevalent with increasing glaucoma severity. Erb et. al²⁸ observed that POAG inpatients had higher score for depression with BDI than outpatients, citing the reason that the severity of glaucoma had been more in inpatients than the outpatients. With progressive increase in vision loss and consequent worsening of glaucoma, the impairment in ability to function optimally escalates and social restrictions get imposed which may perpetuate emotional and sleep problems in these patients.

Chuandi Zhou et al²⁹ have attributed self reported visual functions being consistently correlated with anxiety and depression in glaucoma patients and has emphasized self reported visual function as predictor of anxiety in glaucoma patients. Lundmark et. al³⁰ also reported a disproportionate relationship between depression and visual field loss. They suggested that patient related outcomes are more reflective of their psychological status than objective clinical measures, such as MD of visual field, visual acuity and IOP.

Nevertheless, contrary to the above observations, observations of this study suggest that objective measures are equally important in predicting psychological status. In our study visual acuity and

severity of glaucoma were strongly correlated with insomnia and depression. These objective clinical measures are the principal component in determining the severity of glaucoma which in turn has been correlated with psychological symptoms in many studies.^{6,27} Hence it is imperative to understand and vindicate the correlation between objective clinical measures and psychological symptoms, instead of merely relying much on clinical symptoms as risk factor for anxiety and depression in glaucoma patients.

V. CONCLUSION

This study concludes that insomnia and depression were in 37% and 36% of glaucoma patients. Significantly more insomnia and depression were found in these patients in older age group. Objective clinical parameters exhibit great potential in evaluating psychological factors. Consequently the psychological factors should equally be considered of paramount importance to deliver a comprehensive treatment. Hence clinician should be made acquainted to identify and address the concomitant sleep problems and depression and a proper psychiatric referral if needed to provide comprehensive care.

CONFLICT OF INTEREST

None declared till now.

REFERENCES

- [1] Van Gestel A, Webers CAB, Beckers HJM, et al. The relationship between visual field loss in glaucoma and health-related quality-of-life. *Eye (Lond)* 2010;24(12):1759–1769
- [2] Friedman DS, Okeke CO, Jampel HD, et al. Risk factors for poor adherence to eyedrops in electronically monitored patients with glaucoma. *Ophthalmology*. 2009;116(6):1097–1105.
- [3] Jayawant SS, Bhosle MJ, Anderson RT, Balkrishnan R. Depressive symptomatology, medication persistence, and associated healthcare costs in older adults with glaucoma. *J. Glaucoma*. 2007;16(6):513–520.
- [4] Mabuchi F, Yoshimura K, Kashiwagi K, et al. High Prevalence of Anxiety and Depression in Patients With Primary Open-angle Glaucoma. *Journal of Glaucoma*. 2008 ;17 (7) :552–557.
- [5] Yochim BP, Mueller AE, Kane KD, Kahook MY. Prevalence of Cognitive Impairment, Depression, and Anxiety Symptoms Among Older Adults With Glaucoma. *J Glaucoma*. 21(4):250-4
- [6] Skalicky S, Goldberg I. Depression and quality of life in patients with glaucoma: a cross-sectional analysis using the Geriatric Depression Scale-15, assessment of function related to vision, and the Glaucoma Quality of Life-15. *J. Glaucoma*. 2008;17(7):546–551
- [7] Jampel HD, Frick KD, Janz NK, et al. Depression and mood indicators in newly diagnosed glaucoma patients. *Am. J. Ophthalmol*. 2007;144(2):238–244.
- [8] Waller EA, Bendel RE, Kaplan J (2008). Sleep Disorder and the Eye. *Mayo Clin Proc* 83: 1251–1261.
- [9] Kroenke, K., Spitzer, R.L., Williams, J.B., 2001. The PHQ-9: validity of a brief depression severity measure. *J. Gen. Intern. Med*. 16, 606–613.
- [10] Wittkampf, K.A., Naeije, L., Schene, A.H., Huyser, J., van Weert, H.C., 2007. Diagnostic accuracy of the mood module of the Patient Health Questionnaire: a systematic review. *Gen. Hosp. Psychiatry* 29, 388–395.
- [11] Bastien, C.H., Vallieres, A., Morin, C.M., 2001. Validation of the Insomnia Severity Index as an outcome measure for insomnia research. *Sleep Med*. 2, 297–307.
- [12] Yu, D.S., 2010. Insomnia Severity Index: psychometric properties with Chinese community-dwelling older people. *J. Adv. Nurs*. 66, 2350–2359.
- [13] Lahan, V., Gupta, R., 2011. Translation and validation of the insomnia severity index in Hindi language. *Indian J. Psychol. Med*. 33, 172–176.
- [14] Wang SY, Singh K, Lin SC. Prevalence and predictors of depression among participants with glaucoma in a nationally representative population sample. *Am J Ophthalmol* 2012;154:436-44
- [15] Mitsonis C, Dimopoulos N, Psarra V, et al. Depression and anxiety in patients with glaucoma: a prospective, case control study. *Annals of General Psychiatry* 2006, 5: 10-20.

- [16] Seixas, Azizi, et al. "Relationship between Visual Impairment, Insomnia, Anxiety/Depressive Symptoms among Russian Immigrants." *Journal of sleep medicine and disorders* 1.2 (2014).
- [17] Li Y, Zeng Y, Chen ZF, Zhang XJ, Duan XY, et al. (2007) Investigation of sleep quality in patients with primary angle-closure glaucoma. *Journal of Kunming Medical College* 28: 55–58.
- [18] Waller EA, Bendel RE, Kaplan J. Sleep disorders and the eye. *Mayo Clin Proc.* 2008;83:1251–1261.
- [19] Lin CC, Hu CC, Ho JD, Chiu HW, Lin HC. Obstructive sleep apnea and increased risk of glaucoma: a population-based matched-cohort study *Ophthalmology*.2013;120:1559–1564.
- [20] Chen HY, Chang YC, Lin CC, Sung FC, Chen WC. Obstructive sleep apnea patients having surgery are less associated with glaucoma. *J Ophthalmol.* 2014;2014:838912.
- [21] Dhillon S, Shapiro CM, Flanagan J. Sleep-disordered breathing and effects on ocular health. *Can J Ophthalmol.* 2007;42:238–243.
- [22] US Food and Drug Administration. FDA approves Hetlioz: first treatment for non-24 hour sleep-wake disorder in blind individuals [news release] 2014
- [23] Akindipe TO, Aina OF, Onakoya AO. Risk of depression and subjective quality of life among attendees of a west African glaucoma clinic. *Int J Med Med Sci*,2011;1(2):31-34
- [24] Wang H, Zhang Y, Ding J, Wang N (2013) Changes in the Circadian Rhythm in Patients with Primary Glaucoma. *PLoS ONE* 8(4)
- [25] Pokorny J, Smith VC, Lutze M (1987) Aging of the human lens. *Appl Opt* 26: 1437–1440.
- [26] Wu YH, Swaab DF (2007) Disturbance and strategies for reactivation of the circadian rhythm system in aging and Alzheimer's disease. *Sleep Med* 8: 623–636.
- [27] Mabuchi FYoshimura K, Kashiwagi K, et al. Risk factors for anxiety and depression in patients with glaucoma. *Br J Ophthalmol* 2012;96:821-825
- [28] Erb C, Batra A, Bromer A, et al. Psychiatric manifestations in patients with primary open angle glaucoma. *Ophthalmology*, 1993;90:635-39
- [29] Chuandi Z, Shaohong Q, Pexia W, Chen Q. Anxiety and depression in Chinese patients with glaucoma: Sociodemographic, clinical, and self reported correlates. *Journal of psychosomatic Research*, 2013;75-82
- [30] Lundmark PO, Trope GE, Shapiro CM, Flanagan JG. Depressive symptomatology in tertiary care glaucoma patients. *Can J Ophthalmol*, 2009;44:198-204.