Glaucoma awareness amongst the final year nursing students

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Abstract

Introduction: Glaucoma is defined as an optic neuropathy characterized by specific structural findings in the optic disc. Glaucoma is the second commonest cause of blindness.

Elimination of glaucoma blindness is feasible when adequate measures are taken at all levels of services from the primary level to advanced tertiary level. Health care personnel can be effective in promoting the public awareness of glaucoma provided they have a fair knowledge of the disease. This study was conducted to evaluate awareness about glaucoma amongst the final year nursing students, who will be soon becoming health care personnel.

Materials and Methods: All final year GNM and BSC nursing students of Sri Siddhartha nursing college willing to participate in the study were included. Closed ended questionnaire specific to Knowledge regarding glaucoma awareness were used. Awareness was evaluated in 4 aspects, regarding glaucoma disease per se, disease diagnosis, treatment modalities, and the social impact of the disease. It was a cross-sectional study for each batch of students. Ethical clearance was taken from the institutional ethical committee.

Observations: In our study knowledge regarding the disease can be said to be fair knowledge among our participants (54.09%). The knowledge regarding the disease diagnosis was poor (42.85%). The overall knowledge regarding disease treatment was found to be Fair (53.58%), however many (8.19%), no responses were provided. Also the knowledge regarding the social impact of the disease was found to be Fair (52.86%).

Conclusion: Lack of adequate knowledge regarding glaucoma related blindness, poses a challenge towards the control of this disease.

We found the knowledge regarding the disease, treatment modality and social aspect to be fair knowledge regarding disease diagnosis was poor.

More emphasis should be given towards dissemination of knowledge regarding the diagnosis of the disease .However there is scope of improvement in the knowledge aspects of treatment modalities and the social rehabilitative aspects of glaucoma in the paramedic seminars, workshops and educational symposias.

Keywords: Irreversible blindness, Glaucoma, Nursing students, Paramedics.

Introduction

Glaucoma is defined as an optic neuropathy characterized by specific structural findings in the optic disk (increased vertical cup disk ratio (VCDR) or VCDR asymmetry and particular functional deficits in automated visual field testing.[1] In the past, raised intraocular pressure (IOP) was used as a defining characteristic for glaucoma; but now IOP is considered as just an important risk factor for glaucoma. Glaucoma is included as one of the priorities among the avoidable blinding condition in the country under Vision 2020 Right to Sight India program.[2]

Glaucoma is the second commonest cause of blindness all over the world, contributing to 80% of the global burden of blindness (WHO estimation in 2010).[3] Glaucoma is the most common cause of irreversible blindness globally. It is estimated that more than 3 million people are blind due to glaucoma.[3]

In India, the estimated cases of glaucoma is 12 million, around one fifth of the global burden of glaucoma.[2] and third most common cause of blindness with a prevalence of 5.8% among the blind, next to cataract and uncorrected refractive errors. Nearly half of the blind people are unaware of their condition.[4]

Glaucoma is called as a thief of vision, as patients are unaware of the condition till a very late stage and hence awareness and regular screening of the patients becomes a important step towards managing this disease. Elimination of glaucoma blindness is feasible only when adequate measures will be taken at all levels of services from the primary level to advanced tertiary level. There is a need for a massive health education campaign for glaucoma awareness in the community.[3]

To avoid visual impairment and blindness resulting from glaucoma in community, timely eye examination and appropriate treatment is necessary. Health care personnel can be effective in promoting the public awareness of glaucoma and considered important tools in the dissemination of knowledge about glaucoma prevention and treatment. However, this is only possible if these personnel are aware of glaucoma and have a fair knowledge of the disease.[1]

Hence in our study we tried to determine the level of knowledge regarding glaucoma among nursing students. The knowledge was evaluated in regards to 4 aspects of the disease, namely glaucoma the disease, the diagnostic methods, treatment modalities and lastly on the social aspects of the disease.

Materials and Methods

All final year GNM and BSC nursing students of Sri Siddhartha nursing college, Tumkur who were willing to participate were recruited for the study. After informed consent closed ended questionnaire specific to Knowledge regarding glaucoma awareness were handed over to the final

year GNM and BSC nursing students. The questionnaire was designed to the evaluate the knowledge in 4 aspects of glaucoma, namely the disease, the diagnostic methods, treatment modalities and the social impact of the disease. These are the students who undergo clinical rotation, and will be passing out in near future to serve the society as paramedic staffs, hence this batch was selected. The study was proposed to be conducted from June 2017 to June 2018. Proposed sample size is 61. It was a cross sectional study for a given batch of students. The response was compiled in percentile form and analysed.

Inclusion Criteria: All final year GNM and BSC students of Sri Siddhartha nursing college, Tumkur, who volunteered were included in the study.

Students who were not willing to participate were excluded.

The data collected was tabulated and evaluated in a percentile manner.

Table 1: Knowledge regarding the disease

S. No	Question	Correct response	Incorrect Response	No Response
1	Characteristic feature of glaucoma	58 (95.08%)	3 (4.90%)	None
2	Glaucoma is reversible disease	19 (31.14%)	39 (63.93%)	3 (4.91%)
3	Glaucoma is inherited in family	46 (75.40%)	14 (22.95%)	1 (1.63%)
4	Glaucoma is a preventable cause of blindness	10 (16.39%)	48 (78.68%)	3 (4.91%)
5	Patient remains unaware of the disease till the last stage	21 (34.42%)	30 (49.18%)	10 (16.39%)
6	Steroid can induce glaucoma	44 (72.13%)	13 (21.31%)	4 (6.55)

On evaluating knowledge about the disease, 3 questions out of 6 where responded to with appropriate answers by more than 70% of the participants. So for those questions the knowledge was found to be at a good level.

However the remaining 3 questions were answered correctly only by a mean of 16.7 (27.31%) of participants. Hence the grade of knowledge was characterised as poor.

So to conclude since 3 questions were having Good knowledge and 3 having poor knowledge, overall knowledge regarding the disease can be said to be Fair knowledge (54.09%) among our participants.

Table 2: Knowledge regarding disease diagnosis

S. No	Question	Correct Response	Incorrect Response	No Response
7	Type of vision loss in glaucoma	24 (39.34%)	37 (60.66%)	0
8	Glaucoma Progression is evaluated on	25 (40.98%)	34 (55.73%)	2 (3.27%)
9	Glaucoma causes painfull loss of Vision	30 (49.18%)	29 (47.54%)	2 (3.27%)
10	Risk Factors for glaucoma	11 (18.03%)	45 (73.76%)	5 (8.19%)
11	Glaucoma reduces night vision	25 (40.98%)	26 (42.62%)	10 (16.39)
12	Glaucoma being a irreversible optic neuropathy	41 (67.21%)	12 (19.67%)	8 (13.11%)
13	Glaucoma diseases which manifests as ocular emergency	27 (44.25%)	34 (55.73%)	0

On evaluating the knowledge regarding disease diagnosis, out of 7 questions only one question was given a appropriate response by 67.21% of participants which amounted to be a Fair response.

The question having the fair response was an important one, regarding the irreversible damage of the optic nerve in glaucoma. Having a fair knowledge in this field makes the paramedic staff vigilant in screening of the disease and also can play a vital role in preventing this irreversible disease.

The question regarding the risk factors for glaucoma was distinctly showing poor knowledge with 73.76% giving

a incorrect response. The correct answer for risk factor being myopia and thyrotoxicosis both.

The remaining 5 questions were responded correctly only by an average of 42.94% of participants. Incorrect response was given by an average of 52.45% of cases.

Hence an average of only 42.85% of correct response were received in this aspect of knowledge.

Table 3: Knowledge regarding disease treatment

S. No	Question	Correct Response	Incorrect Response	No. Response
14	Glaucoma treatment modalities	36 (59.01%)	25 (40.94%)	0
15	Glaucoma is cured with medicines	26 (42.62%)	33 (54.09%)	2 (3.27%)
16	Risk with topical Beta –Blockers	8 (13.11%)	32 (52.45%)	20 (32.78%)
17	Surgery as the first choice for glaucoma	41 (67.21%)	17 (27.85%)	3 (4.91%)
18	Regular Screening for glaucoma is essential	52 (85.24%)	9 (14.74%)	0

On evaluating knowledge regarding disease treatment, only 2 out of 5 questions were being responded correctly by 67.21%, 85.24% of the participants respectively. These questions evaluated the knowledge of surgical treatment for glaucoma and regular screening in glaucoma, for which the response amounted to a good knowledge amongst participants.

On evaluating the risk of topical beta blocker drops which is the commonest anti-glaucoma drug prescribed, almost 32.78% responded as no knowledge regarding the fact of precipitation of an asthma attack in the patient. This also added to the poor knowledge amongst the participants.

Hence the overall knowledge regarding disease treatment was found to be correct in 53.58% of cases and incorrect responses were given by 38% of cases, however 8.19% participants responded as no knowledge in this aspect of the disease, which was on a higher side compared to other questionnaire categories. So the overall knowledge continues to be fair in this category of questions.

Table 4: Knowledge on social aspect of the disease

S. No	Questions	Correct response	Incorrect response	No Response
19	Glaucoma is known as a thief of vision	36 (59.01%)	12 (19.67%)	13 (21.3%)
20	Glaucoma is screened in which subjects	25 (40.98%)	28 (45.89%)	8 (13.11%)
21	Advanced glaucoma patients, have blindness benefits	38 (62.29%)	15 (24.59%)	8 (13.11%)
22	Low vision aids are available for rehabilitation of advanced glaucoma	30 (49.18%)	20 (32.78%)	11 (18.03%)

On evaluating the knowledge on social aspect of the disease, only 1 question which was about social aspect of the disease had a fair response of about (62.29%). The question regarding the blindness benefits to the patients was evaluated in this question, which showed a fair knowledge.

The correct response was given by 52.86% of the participants, which amounts to a fair knowledge among the participants regarding this aspect. Incorrect response was given by 30.73% of the population, whereas 16.38% of participants did not respond with any answer and hence the knowledge was overall poor.

Hence to conclude, we found the knowledge regarding the disease, treatment modality and social aspect to be fair whereas knowledge regarding disease diagnosis to be poor.

Intraocular pressure elevation results in a reduction in ocular perfusion pressure with the associated possibility of mechanical and ischaemic damage to the optic nerve head. A key consideration is the possibility that, rather than being beneficial for patients who are susceptible to glaucomatous pathology, any intraocular pressure elevation could be detrimental.[6]

In our study 95.08%, participants said raised IOP as the cause of glaucoma which was a good response.

In a study conducted by Samuel et al in Ghana,[7] 65.9 percent participant agreed that glaucoma is defined as high IOP, whereas another study by Adegbehingbe and Bisiriyu in Nigeria reported 39% agreeing that raised IOP is associated with glaucoma.[1]

Elevated intraocular pressure is a important risk factor for the development and progression of glaucoma.[8] Treatment modalities reducing intraocular pressure has demonstrated reduction in glaucoma progression.[9]

Glaucoma is the third largest cause of blindness all over the world following cataract and trachoma which accounts for more than 14% of total blind population.[3] However, in terms of causes of irreversible blindness, glaucoma is the most leading cause in this group.

In our study 39(63.93%) knew that it is a irreversible blindness, this is a fair grade of knowledge. We desire a better knowledge regarding this point as it gives the impact of the disease in the patient life.

In our study (46) 75.40% participants knew that glaucoma is a heritable disease whereas (14)22.95% patients didn't know about the heritable characteristics of the disease. Whereas 4 participants didn't comment on the reversibility of blindness.

Hence the knowledge about the heritable characteristics and eventually the screening of the patient siblings and children was found to be good.

Glaucoma may be sporadic but definitely has been found to have a very strong link with the family history.[10,11] Incidence of POAG increases two to three times in cases of family history of glaucoma among siblings.

Glaucoma is a leading cause of preventable blindness in the adult population. To reduce the risk of blindness due to glaucoma, the literature suggests to encourage early diagnosis of the disease in the community, including the scale of the problem; access to primary care; and educating the public about the condition, its risk factors, treatment, and outcomes.[12]

The changes induced by glaucoma are not curable, but medical and/or surgical treatment, when properly prescribed, can prevent blindness as long as the condition is diagnosed early. The population should be made aware of the importance of ophthalmic monitoring and treatment, emphasising the importance of periodic campaigns.[13]

In our study 48 (78.68%) participants agreed that it is a preventable cause of blindness which is a good knowledge.Only 10(16.3%) said that it is not and 21.30% did not comment on it.

The vision loss due to glaucoma has traditionally been described as loss of "peripheral vision"; that is, loss of vision at the outer edges.[14-17]

In addition to visual field losses, reduction of contrast sensitivity and colour discrimination can occur early in the disease process.[18-20] Additionally, patients may report other visual symptoms due to glaucoma, such as blurred vision, dimness or cloudiness.

According to Cindy et al the most common symptoms reported by patients with early or moderate glaucoma was increased background illumination requirement, blurry vision and glare.[21]

In our study 44 (72.13%) patients were aware that steroids cause glaucoma which is a good awareness amongst the participants. 13 (21.31%) participants were not aware of the steroid induced diseases. And 4 (6.55%) did not comment on the association.

Steroid-induced glaucoma is an iatrogenic and preventable disease. The unwarranted and irrational use of steroids especially in developing countries by local medical practitioners as well as unmonitored self-use by patients themselves points to a lack of awareness about the disease. Prevention of steroid-induced glaucoma can be achieved with a few simple precautions, such as identification of risk factors (like POAG, family history, high myopia, diabetes mellitus, and connective tissue disorder) and monitoring for ocular hypertension can decrease the risk. Discouraging self-medication, monitoring for IOP after prescription of steroids in any form and prompt management is essential. These practical and safe guidelines for the use of steroids should be followed by all doctors.[22]

On evaluating the knowledge regarding disease diagnosis.

On evaluating the knowledge of type of vision loss in glaucoma 29(47.54%) of our participants said that it causes vision loss, 24 (39.34%) agreed that it causes visual field loss and only 8(13.11%) said colour vision loss.

Glaucoma was known to cause visual field loss than vision loss as a initial manifestation. However now a days the visual field loss can also be a late manifestation.23

The knowledge regarding evaluation of glaucoma, 13 (21.31%) agreed that it is monitored on perimetry, whereas 21(34.42%) agreed that it is monitored on Intra ocular pressure, and only 2(3.27%) said that both has to be done.

The ideal method for evaluation is both, periodic IOP monitoring and perimetry. However IOP is recommended more frequently than perimetry.

The detection of visual field progression continues to be a challenging area of glaucoma management. Increasingly, it is clear that rates of change are very important; therefore, the use of trend-based analyses will likely be more heavily utilized in conjunction with event-based methods on serial perimetries.

On evaluation regarding glaucoma causing a painful loss of vision, 29(47.54%) agreed that it causes a painful loss of vision, 30 (49.18%) agreed that it causes painless loss of vision whereas 2(3.27%) did not comment on vision loss.

The symptoms of glaucoma results in vision loss with concomitant reduction in quality of life and the ability to perform daily activities, such as driving. Early intervention is essential to slow the progression of the disease.

Pain can be a presenting complains of angle closure glaucoma and secondary glaucoma's.

Primary angle closure patients often complain of ocular pain, nausea, vomiting, and intermittent blurring of vision with haloes noticed around lights.[24]

Knowledge regarding the risk factors for glaucoma; 4(6.55%) agreed that thyrotoxicosis is a risk, 41 (67.21%) agreed that myopia is a risk, 11(18.03%) knew that both are risk factors whereas 5(8.19%) had no knowledge about the risk factors.

Individuals with hypothyroidism have an increased risk of developing POAG.[25,26]

Glaucoma can cause night blindness in advanced cases, which can cause difficulty in navigation in night time, for which 25 (40.98%) said that it does, whereas 26 (42.62%)

agreed that it doesn't and 10 (16.39%) said that they didn't know.

In a study by Nelson et al Difficulties related to lighting, such as glare and difficulty adapting to different levels of light, consistently ranked as the most frequent complaint amongst glaucoma patients.[27,28]

On evaluating knowledge regarding glaucoma causing irreversible optic atrophy 41(67.21%) believed it does cause whereas 12(19.67%) participants believed that it doesn't whereas 8(13.11%) did not comment on it.

This is an important aspect of glaucoma related blindness, knowledge of which is essential.

Ganglion cell death in glaucoma is primarily due to apoptosis, and is thought to result from a decrease in the level of trophic material these neurons receive from their target neurons in the visual thalamus following optic nerve injury and optic atrophy.[29]

On evaluating the knowledge about acute ocular emergency conditions, which need intervention 34 (55.73%) patients believed open angle glaucoma is, whereas 3(4.91%) patients said that narrow angle glaucoma is an ocular emergency, 8(13.11%) participants chose secondary glaucoma as a ocular emergency.

In a study by Hany et al, they found acute angle closure in 75% of cases, neovascular glaucoma in 44% of cases and open angle glaucoma in none of the cases.[30]

On Evaluating Knowledge Regarding the Disease Treatment Modality

On asking about glaucoma treatment modalities can be treated by topical drops 1(1.63%) said that it can be treated by topical drops, 6 (9.83%) patients believed it can be treated by lasers, 16 (26.22%) patients believed it can be treated by surgery, 36(59.01%) believed that all of the above modalities can be used

The options including all of the above should be ideal response which was not found to be till a satisfactory level

Significant progress has been made in developing pharmacological agents and surgical procedures that can significantly enhance the ability to control intra ocular pressure (IOP) and the vision loss associated with glaucoma.[31]

"I request every doctor to play the role of a teacher in advising every family on eye disease prevention particularly glaucoma and methods to maintain a healthy vision. I hope you all will find time for this noble action."

On evaluating Glaucoma medications can cure glaucoma 33 (54.09%) believed that it can, 26(42.62%) believed that it can t and 2 (3.27%) said that they don't know about the blindness progression.

In a study by Dorothea et al, approximately 1 out of 6 glaucoma patients were bilaterally blind from glaucoma at the last visit. Median duration of bilateral blindness was 2 years.

Hence it is not a curable blindness.[32]

On evaluating an important side effect of topical beta blocker, which is the first line of therapy in all types of glaucoma, it was found that 8(13.11%) said that it does cause bronchial asthma, 32 (52.45%) believed that it causes hypertension, 20(32.78%) believed that no significant side effect exists.

Non-selective beta-blocker eye drops are known to significantly affect lung function and increase asthma morbidity.[33]

On inquiring if surgery is always the first choice in glaucoma amongst the participants, 5(8.19%) patients believed it is, 41(67.21%) believed it is not, and 3 (4.91%) didn't know about the choice.

The concept of maximum tolerated medical therapy (MTMT) is practised in glaucoma which is defined as the achievement of the greatest possible IOP reduction with largest number of medications that the patient can tolerate and is willing to be compliant in administering regularly. Thus, the first step in treatment of glaucoma is to maximize medical therapy and make sure that the patient can adheres to the regimen.

Surgery should be considered whenever medical or laser treatment would appear unlikely to maintain sight in the glaucomatous eye. It should not be left as a last resort.

On inquiring whether glaucoma requires screening-5(8.19%) said that it does only once, 4(6.5%) patients said that it never requires whereas 52(85. 24%) said that it requires based on disease progress.

Clinical screening in glaucoma should be approached on multiple levels; involving optometrists, general/family physicians, and ophthalmologists who should rule out glaucoma in their referrals.[34]

Knowledge about Social Aspects of the Disease

Knowledge about glaucoma being called as thief of vision was known in 36 (59.01%), 12(19.67%) said that it is not, whereas 13(21.31%) said they don't know about it.

It is a known fact that multiple interventions and approaches are required to reduce glaucoma blindness, the "silent thief of sight".[35,36]

On evaluating the knowledge that glaucoma should be screened in which patients, 18(29.5) said only in siblings 10(16.39%) said off springs, 25(40.98%) both and 8(13.11%) said none.

Corneal hysteresis, intraocular pressure, and central corneal thickness are heritable and may be suitable end phenotypes in the search for genes for open-angle glaucoma. Hence these parameters may contribute to the to disease preponderance in genetically related individuals.[37]

On evaluating the knowledge that advanced glaucomatous disease patients can get benefits of blindness 38(62.29%) patients said they do, whereas 15(24.59%) said it doesn't and 8(13.11%) were not aware.

A limitation of field of vision to under 20° from central point of fixation in the better eye is also considered blindness, this is given by central Coordination committee under National programme for control of blindness.[38]

Regarding knowledge that Low vision aids can rehabilitate glaucoma 30(49.18%) said it does 20(32.78%) said no and 11 (18.03%) said they were not aware.

Effective low vision intervention in patients with advanced visual field damage due to glaucoma should start as soon as the patient experiences difficulty performing day-today tasks. Realistic goals of intervention and the devices that could be helpful for the patient should be discussed with the patient. Since the visual acuity, visual field loss and contrast sensitivity progressively deteriorate with advancing age, the sooner patients adopt low vision aid devices, the better it is.[39]

Community, paramedics and medicos, together play a vital role in early detection and timely management of glaucomatous blindness. Paramedic staff are the vital links between the community and the medical staff, and can help in dissemination of knowledge regarding glaucomatous blindness. According to our study the knowledge regarding the disease was fair, however the knowledge regarding diagnosis, treatment and social aspects of the disease was poor, suggesting that we need improvement in knowledge about these aspects of the disease amongst the paramedics.

Conclusion

Lack of adequate knowledge regarding glaucoma related blindness, poses a challenge towards the control of this disease

We found the knowledge regarding the disease, treatment modality and social aspect to be fair

Knowledge regarding disease diagnosis was poor.

More emphasis should be given towards dissemination of knowledge regarding the diagnosis of the disease. However there is scope of improvement in the knowledge aspects of treatment modalities and the social rehabilitative aspects of glaucoma in the paramedic seminars, workshops and educational symposias.

Conflict of Interest: None.

References

1. Adegbehingbe BO, Bisiriyu LA. Knowledge, attitudes and self-care practices associated with glaucoma among hospital workers in Ile-Ife, Osun State, Nigeria. *Tanzan J Health Res* 2008;10(4):240–245.
2. Sathyamangalam RV, Paul PG, George R, Baskaran M, Hemamalini A, Madan RV, Augustian J, Prema R, Lingam V. Determinants of glaucoma awareness and knowledge in urban Chennai. *Indian J Ophthalmol* 2009;57(5):355–360.
3. Quigley HA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020. *Br J Ophthalmol* 2006;90(3):262–267.
4. Ichhpujani P, Bhartiya S, Kataria M, Topiwala *P.J* Knowledge, Attitudes and Self-care Practices associated with Glaucoma among Hospital Personnel in a Tertiary Care Center in North India. 2012;6(3):108-112.
5. Prabhu M, Patil SH, Kangokar PR. Glaucoma awareness and knowledge in a tertiary care hospital in a tier-2 city in South India. *J Sci Soc* 2013;40:3-8.
6. Charles William McMonnies. Intraocular pressure and glaucoma: Is physical exercise beneficial or a risk. *J Optom* 2016;9(3):139–147.
7. Samuel Kyei, Khathutshelo P Mashige, Rekha Hansraj. Awareness, knowledge and self-care practices toward glaucoma among final year health science university students in Ghana. *Clin Exp Optom* 2015;98:160–166.
8. Gardiner S.K., Fortune B., Wang L., Downs J.C., Burgoyne C.F. Intraocular pressure magnitude and variability as predictors or rates of structural change in non-human primate experimental glaucoma. *Exp Eye Res* 2012;103:1–8.
9. Detry-Morel M. Currents on target intraocular pressure and intraocular pressure fluctuations in glaucoma management. *Bull Soc Belge Ophtalmol* 2008;308:35–43.
10. Chan EW, Li X, Tham YC. Glaucoma in Asia: regionalprevalence variations and future projections. *Br J Ophthalmol* 2015;(June). http://dx.doi.org/10.1136/bjophthalmol-2014-306102. pii: bjophthalmol-2014-306102 [Epub ahead of print].
11. Dandona L, Dandona R, John RK. Estimation of blindness in India from 2000 through 2020: implications for the blindness control policy. *Natl Med J India* 2001;14:327–334.
12. Costa VP, Almeida GV, Jose NK. Prevenção da cegueira por glaucoma. *Arq Bras Oftalmol* 1998;61(3):356-360.
13. Michelle Rodrigues GonçalvesI, Marielle de Medeiros Rodrigues Guedes, Mario Augusto Pereira Dias Chaves, Carla Cristina de Lima Pereira, Rosemari OttonI Analysis of risk factors and epidemiology of blindness prevention campaign by glaucoma in João Pessoa, Paraíbaev. *Rev Bras Oftalmol* 2013;72(6):396-399.
14. Duke-Elder S. Diseases of the Lens and Vitreous: Glaucoma and Hypotony, in System of Ophthalmology Volume XI. London, United Kingdom: Henry Kimpton; 1969.
15. Chandler PA, Grant WM. Glaucoma, 2nd ed. Philadelphia (PA): Lea & Febiger; 1979.
16. Kolker AE, Hetherington J, Jr. Becker-Shaffer's Diagnosis and Therapy of the Glaucomas, 4th ed. St Louis (MO): Mosby Co; 1976
17. Heilmann K, Richardson KT. Glaucoma: Conceptions of a Disease. Philadelphia (PA): WB Saunders Co; 1978.
18. Drance SM, Lakowski R, Schulzer M. Acquired color vision changes in glaucoma. Use of 100-hue test and Pickford anomaloscope as predictors of glaucomatous field change. *Arch Ophthalmol* 1981;99:829–831.
19. Hawkins AS, Szlyk JP, Ardickas Z. Comparison of contrast sensitivity, visual acuity, and Humphrey visual field testing in patients with glaucoma. *J Glaucoma* 2003;12:134–138.
20. Lakowski R, Drance SM. Acquired dyschromatopsias: the earliest functional losses in glaucoma. *Doc Ophthalmol Proc Ser* 1979;19:159–165.
21. Cindy X. Hu, Camila Zangalli, Michael Hsieh, Lalita Gupta, Alice L. Williams, Jesse Richman, et al. What Do Patients With Glaucoma See? Visual Symptoms Reported by Patients with Glaucoma. *Am J Med Sci* 2014;348(5):403–409.
22. Sonia Phulke, Sushmita Kaushik, Savleen Kaur, SS Pandav. Steroid-induced Glaucoma: An Avoidable Irreversible Blindness. *J Curr Glaucoma Pract* 2017;11(2):67–72.
23. Angelo P. Tanna, Rajen U. Desai. Evaluation of Visual Field Progression in Glaucoma. *Curr Ophthalmol Rep* 2014;2(2):75–79.
24. Robert N. Weinreb**,** Tin Aung**,** Felipe A. Medeiros. The Pathophysiology and Treatment of Glaucoma, A Review. *JAMA* 2014;311(18):1901–1911.
25. Charles W. McMonnies. Glaucoma History and risk factors. *J Optom* 2017;10(2):71–78.
26. Shiming Wang, Yue Liu, Guangying Zheng. Hypothyroidism as a risk factor for open angle glaucoma: A systematic review and meta-analysis. *PLoS One* 2017;12(10): e0186634.
27. Nelson P, Aspinall P, O'Brien C. Patients' perception of visual impairment in glaucoma: a pilot study. *Br J Ophthalmol* 1999;83(5):546-552.

28. Janz NK, Wren PA, Lichter PR, Musch DC, Gillespie BW, Guire KE, Mills RP. The Collaborative Initial Glaucoma Treatment Study: interim quality of life findings after initial medical or surgical treatment of glaucoma. *Ophthalmol* 2001;108(11):1954-1965.
29. Retinal ganglion cell death in glaucoma: the how, the why, and the maybe. *Nickells RW J Glaucoma* 1996;5(5):345-356.
30. Hany E El-Mekawey, Khaled G Abu El Einen. Epidemiology of ocular emergencies in the Egyptian population: a five-year retrospective study. *Clin Ophthalmol* 2011;5:955–960.
31. Sundaram Natarajan. Recent trends in Glaucoma management. *Indian J Ophthalmol* 2013;61(7):317–318.
32. Dorothea Peters Boel Bengtsson Anders Heijl. Lifetime Risk of Blindness in Open-Angle Glaucoma. *Am J Ophthalmol* 2013;156(4):724-730.
33. Daniel R. Morales, Tobias Dreischulte, Brian J. Lipworth, Peter T. Donnan, Cathy Jackson, Bruce Guthrie. Respiratory effect of beta-blocker eye drops in asthma: population-based study and meta-analysis of clinical trials. *Br J Clin Pharmacol* 2016;82(3):814–822.
34. Paul Harasymowycz, Catherine Birt, Patrick Gooi, Lisa Heckler, Cindy Hutnik, Delan Jinapriya et al. Medical Management of Glaucoma in the 21st Century from a Canadian Perspective. *J Ophthalmol* Volume 2016, Article ID 6509809, 22 pages.
35. Seyed-Farzad Mohammadi, Ghasem Saeedi-Anari, Cyrus Alinia, Elham Ashrafi, Ramin Daneshvar, Alfred Sommer. Is Screening for Glaucoma Necessary? A Policy Guide and Analysis. *J Ophthal Vis Res (JOVR*) 2014;9(1):3–6.
36. Mohammed Mahdi Abdul. Glaucoma, "the silent thief of sight": patients' perspectives and health seeking behaviour in Bauchi, northern Nigeria. *BMC Ophthalmol* 2016;16:44.
37. Ellen E. Freeman, Marie-Hélène Roy-Gagnon, Denise Descovich, Hugues Massé, and Mark R. Lesk. The Heritability of Glaucoma-Related Traits Corneal Hysteresis, Central Corneal Thickness, Intraocular Pressure, and Choroidal Blood Flow Pulsatility. *PLoS One* 2013;8(1):555-573.
38. Murthy GV, Gupta SK, Bachani D. The Principles and Practice of Community Ophthalmology. New Delhi: National Program for Control of Blindness, Government of India; 2002.
39. Anjani Khanna, Parul Ichhpujani. Low Vision Aids in Glaucoma. *J Curr Glaucoma Pract* 2012;6(1):20–24.

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