Optometry: Open Access

Mini Review Open Access

How Do We Enhance Glaucoma Screening and Reduce Glaucoma Related Blindness?

Annamalai Odayappan[1], Srinivasan Kavitha[1], Sivagami Nachiappan[2] and Rengaraj Venkatesh[1*]

[1]*Department of Glaucoma, Aravind Eye Hospital, Pondicherry, India*

[2]*Department of General Ophthalmology, Indira Gandhi Govt. General Hospital and Post Graduate Institute, Pondicherry, India*

Abstract

Glaucoma is the leading cause of irreversible blindness and this burden has been projected to increase significantly in the years to come.Therefore, various steps need to be taken to tackle this problem and reduce the magnitude of blindness in the community. Screening the general population may not be feasible for glaucoma due to various reasons. This implies that we need to know who the high-risk population is so that we can do a targeted screening. The various risk factors described to be associated with delayed presentation includes older age, African-Caribbean individuals, female gender, socio-economic deprivation, poor literacy, unemployment, rural residence-greater distance from the hospital, patients referred by non-optometrists and presentation with symptoms.The prevalence of primary glaucomas is also greater among family members of known glaucoma patients. An appropriate action would be to screen people with such high-risk factors and thus diagnose glaucoma early. The other major concerns include maintaining patient's compliance to treatment and identification of progression early. Detailed oral counselling and use of modern technology to create awareness have been suggested as aids in maintaining the follow-up. Here, we review the ways of how we could enhance glaucoma screening and maintain long-term follow up, patient care.

Keywords

Glaucoma; Optic neuropathy; Glaucomatous damage; Loss of vision

Introduction

Glaucoma is a chronic, progressive optic neuropathy where initially only the peripheral field is affected but with progression, when undiagnosed or inadequately treated, there is loss of central vision as well. The Intraocular Pressure (IOP) is known to be the most important modifiable risk factor. The World Health Organization has estimated that 12.3% of world blindness is due to glaucoma [1]. It has been estimated that there will be around 112 million people with glaucoma in 2040 [2]. Being the leading cause of irreversible blindness, if the IOP could be controlled, reducing the rate of progression it is possible that the magnitude of blindness due to glaucoma could be significantly cut down. However, to control the disease, firstly it should be diagnosed. Majority of those in the developing world do not know that they have the disease [3]. This factor puts greater importance on screening to facilitate early initiation of treatment.

The prevalence of Primary Open Angle Glaucoma (POAG) in the general population among those over 40 years of age is low ranging from 1.6%-3.5% whereas that of Primary Angle Closure Glaucoma (PACG) is still lower at 0.2%-2.7% [3]. Diagnosing glaucoma also requires evaluation of multiple parameters like IOP, anterior chamber angle, optic disc, and visual fields. None of these in isolation can predict glaucoma with good accuracy and these tests need to be analyzed together [4]. Therefore, screening general population for such a disease requiring multiple parameter assessment and with low prevalence becomes a challenge since it will be time consuming and cost prohibitive.

Glaucoma Severity

A study from Ethiopia found that 44% of patients were unilaterally blind and 18% were bilaterally blind due to glaucoma at presentation [5]. Similar rates of 43% and 15% respectively were reported from Malawi in 2014 [6]. In a developing country like India, our data suggests that there was little bilateral blindness, however, unilateral blindness was seen in 11% of new primary glaucoma patients [7].

Despite improvement in global healthcare, it was found that 60% of patients presented with advanced glaucoma in the better-seeing eye in Brazil [8]. Our own publication suggests that 40% had advanced glaucoma in at least one eye and 15% had bilateral advanced glaucoma at presentation [7].

Risk Factors

It is therefore prudent to identify certain high-risk characteristics associated with greater severity or the presence of glaucoma. A study from Scotland showed that socio-economic deprivation and older age were risk factors for delayed presentation with glaucoma [9]. A retrospective review from London showed that AfricanCaribbean individuals, female gender, patients referred via any source other than an optometrist and those with higher presenting IOP are more likely to present with advanced glaucoma [10]. A study from Nigeria showed that greater distance from the hospital, poor literacy, unemployment, and presentation with symptoms were risk factors associated with end stage disease [11]. Reports from developing countries show that rural residence is associated with more advanced disease at presentation [12]. Our own study in a developing world setting found several factors associated with late presentation among newly diagnosed

***Corresponding author:** Rengaraj Venkatesh, Department of Glaucoma, Chief Medical Officer, Aravind Eye Hospital, Pondicherry, India, E-mail: venkatesh@aravind.org

Received: April 26, 2021; **Accepted:**May 10, 2021; **Published:**May 17, 2021

Citation: Odayappan A, Kavitha S, Nachiappan S, Venkatesh R (2021) How Do We Enhance Glaucoma Screening and Reduce Glaucoma Related Blindness? Optom Open Access 6: 144.

primary glaucoma patients, including older age, lower educational status, unemployment, rural residence and presenting with complaints of defective vision [7]. In addition, presence of a myopic refraction has been described to be a risk factor with 18 times greater chance of progression [13]. Having identified these risk categories, such population should be specifically targeted during screening.

Screening

Glaucoma is predominantly asymptomatic at onset. It is unlikely that the patient would come with defective vision in the early stages. If people presume themselves to be healthy or cannot visit a physician, there should be a conscious effort from the healthcare to reach out to them proactively and screen them to reduce the burden of a silent disease like glaucoma.

This can be done by organizing screening camps in rural areas targeting such individuals with low socioeconomic status and education. With recent advances in fundus imaging where good quality photographs can be taken in the undilated state, glaucoma screening can be much improved in camps. It has been shown that by using digital fundus photography in screening camps, there was a greater detection of posterior segment diseases [14]. Moreover, the IOP estimation can be performed quickly with newer devices like the rebound tonometry which gives objective data there by eliminating human errors in IOP estimation.

Another option would be the setting up primary eye care centres or vision centres in rural areas. Such centres are headed either by an optometrist or an eye care technician who are trained in clinical examination. In contrast to screening camps, these are permanent centres where better facilities like slit lamps, applanation tonometry, fundus imaging are available with the added advantage of facilitating follow up consultations. Patients from the community are examined by these trained ophthalmic technicians following which they contact the base hospital via video conferencing to describe their findings and get advice from an ophthalmologist. If a posterior segment disease is suspected, fundus photography is taken and uploaded for interpretation by the ophthalmologist. Patients with non-vision threatening conditions are prescribed treatment locally. Patients with potentially vision-threatening pathologies like glaucoma are referred to the base hospital at the discretion of the teleconsulting ophthalmologist [15]. Patients seeking care for other ailments can also be fundus imaged and thus screened. By increasing the number of vision centres and bringing tertiary eye care assessment to rural areas, the community can be better taken care of.

It has been shown that both POAG and PACG have a greater prevalence among first degree relatives of patients than the general population [16,17]. Factors such as these needs to be considered for targeted screening. Specific screening or comprehensive evaluation of such individuals can improve the yield of the screening programme. Unlike few other hereditary disorders, the population awareness about glaucoma being a familial disease is generally low [7]. Various educational programmes need to focus on improving this perception and motivating family members to undergo ophthalmic evaluation. We have recently developed a software tool which will maintain the details of the first-degree relatives of patients with POAG and PACG who are diagnosed at the base hospital, generate automated messages to their phone numbers educating them about glaucoma, motivating and offering opportunistic screening.

Other Factors Contributing to Glaucoma Related Blindness

The idea of reducing glaucoma blindness does not stop with early diagnosis alone. Susanna et al. reviewed the reasons for development of glaucoma related blindness, the major ones being that most of the glaucoma is still undiagnosed and there is poor compliance to treatment. They also noted that improper treatment of glaucoma could also play a part where either the glaucoma severity is underestimated, target IOP is not reached, IOP peaks are missed or due to difficulties in evaluating the rate of progression [18].

It is therefore necessary to follow-up patients to ensure that they are compliant with the medication and to assess progression. Compliance is generally evaluated in terms of persistence and adherence. Persistence refers to the period of continuous medication use, that is, the time from the starting date to the end of the last dispensing of the initially prescribed topical medication until there is a gap in the supply. Adherence refers to the prevalence of use of the initial medication at various time points, that is, it evaluates the timely refilling of the medication. A study in the United States of America found that nearly half of patients on medical management discontinued the drops within six months [19]. Lee et al, identified that factors like absence of formal education, not using prescribed medications, poor personal concepts about the need for follow-up, perception that the eye was normal and lack of an accompanying person to be predictors associated with poor follow-up in South India. Detailed counselling, use of audio-visual aids and empowering patient support groups were suggested as possible strategies to overcome these barriers [20]. Various smartphone apps have now become available to set reminders and improve the compliance to medical treatment.

Clinical evaluation of the optic disc and the amount of cupping is highly subjective and is likely to miss early progression. Identifying progression early and escalation of treatment or institution of adjunctive therapies is imperative to reduce glaucoma related blindness. Progression is ideally evaluated using visual fields and optical coherence tomography by one of the two stratégies, évent based analyses or the trend-based analysis. Event-based analysis refers to the comparison of the current test to the baseline or the previous ones manually whereas the trend-based analysis measures the rate of change in the various tests sequentially like using the Guided Progression Analysis software.

A retrospective study by Moraes et al, identified that older age, presence of exfoliation syndrome, decreased central corneal thickness, presence of disc hemorrhage or beta-zone parapapillary atrophy, higher mean or peak IOP, and greater IOP fluctuation were risk factors that were associated with increased risk of visual field progression [21]. Patients with such risk factors need to be closely followed up.

Moreover, it will be prudent to identify patients at risk for rapid progression of glaucoma or those with advanced disease who have not come for the scheduled visit to the hospital from the old case records, call them up and counsel to seek care [22].

It is also important to further evaluate a patient who is progressing despite good compliance and apparently controlled IOP by looking at the peak IOP, diurnal IOP fluctuation. Specific history of night-time intake of anti-hypertensive medications needs to be elicited. This has been mentioned to cause nocturnal hypotension and worsen glaucomatous damage. Additional contributory factors like anaemia and obstructive pulmonary disease which reduces the oxygenation

of blood also needs to be addressed. Stress has been shown to cause vascular dysregulation, reduced parasympathetic activity, elevated oxidative stress, glutamate induced excitotoxicity, down regulation of neurotrophins and glial activation, all of which are involved in the pathogenesis of glaucomatous optic neuropathy. The practice of mindfulness meditation techniques has demonstrated positive effects of reducing mental stress, normalizing stress biomarkers, improving quality of life, and positively modifying the gene expression [23].

Surgery is usually advised when there is progression despite maximal medical treatment. In spite of its necessity, a significant proportion of patients in Nigeria had rejected surgery due to apprehension, cost barriers and preference for medical management [11]. In fact, monitoring the patients even after surgery is a necessity since the success rate drops to 60% at 6 years after trabeculectomy [24]. Taking the time for proper counselling and educating the patients about their disease can improve acceptance rate for surgery [25].

Conclusion

In order to downgrade glaucoma from being the foremost cause of irreversible blindness, various steps like proactive screening, conducting comprehensive eye camps, setting up of primary eye care centres in rural areas, targeted family screening, meticulously following up review patients ensuring compliance, calling up patients who have not reviewed back, early identification of progression with appropriate treatment, institution of adjunctive therapies and health education needs to be enhanced.

Name of the Institution to Which the Work Should be Credited

Aravind Eye Hospital, Pondicherry, India

Source(s) of Support: Nil

Acknowledgement, if Any: Nil

None of the authors have any conflict of interest/financial disclosures.

The manuscript has been read and approved by all the authors, the requirements for authorship have been met for all authors.

Reprint Request: None

References

1. Resnikoff S, Pascolini D, Etya'ale D, Kocur I, Pararajasegaram R, et al. (2004) Global data on visual impairment in the year 2002. Bull World Health Organ 82: 844-851.
2. Tham YC, Li X, Wong TY, Quigley HA, Aung T, et al. (2014) Global prevalence of glaucoma and projections of glaucoma burden through 2040: A systematic review and meta-analysis. Ophthalmology 121: 2081-2090.
3. George R, Ve RS, Vijaya L (2010) Glaucoma in India: Estimated burden of disease. J Glaucoma 19: 391-397.
4. Ausayakhun S, Snyder BM, Ausayakhun S, Nanegrungsunk O, Apivatthakakul A, et al. (2021) Clinic-based eye disease screening employing non-expert fundus photo-graders at the point of screening: Diagnostic validity and yield. Am J Ophthalmol S0002-9394: 00153-00157.
5. Giorgis AT, Mulugeta A, Aga A, Deyassa N (2012) The spectrum of glaucoma presentation at Menelik II Hospital, Addis Ababa. Ethiop Med J 50: 259-264.
6. Kayange PC, Nkume HB, Feyi-Waboso A, Kalua K, Msukwa G, et al. (2014) Presentation of Primary Open Angle Glaucoma (POAG) at lions sight first eye hospital in blantyre, Malawi. Malawi Med J 26: 60-62.
7. Odayappan A, Kavitha S, Ramulu ST, Upadhyaya S, Venkatesh R (2020) Assessment of reasons for presentation in new primary glaucoma patients and identification of risk factors for late presentation. Ophthalmol Glaucoma 3: S2589-4196 (20) 30318-5.
8. Osaki TH, Kasahara N, Della Paolera M, Cohen R, Nishiwaki-Dantas MC (2010) Presentation of glaucoma in an urban tertiary care hospital in South America: Legal blindness and prevalence. Int Ophthalmol 30: 361-366.
9. Ng WS, Agarwal PK, Sidiki S, McKay L, Townend J, et al. (2010) The effect of socio-economic deprivation on severity of glaucoma at presentation. Br J Ophthalmol 94: 85-87.
10. Fraser S, Bunce C, Wormald R (1999) Risk factors for late presentation in chronic glaucoma. Invest Ophthalmol Vis Sci 40: 2251-2257.
11. Abdull MM, Gilbert CC, Evans J (2015) Primary open angle glaucoma in northern Nigeria: Stage at presentation and acceptance of treatment. BMC Ophthalmol 15: 111.
12. Francis AW, Gyasi ME, Adjuik M, Kesse E, Chen Y, et al. (2014) Comparison of primary open angle glaucoma patients in rural and urban Ghana. Afr Health Sci 14: 729-735.
13. Gupta S, Singh A, Mahalingam K, Selvan H, Gupta P, et al. (2021) Myopia and glaucoma progression among patients with juvenile onset open angle glaucoma: A retrospective follow up study. Ophthalmic Physiol Opt.
14. Schehlein EM, Yadalla D, Hutton D, Stein JD, Venkatesh R, et al. (2021) Detection of posterior segment eye disease in rural eye camps in South India: A nonrandomized cluster trial. Ophthalmol Retina 18: S2468-6530 (21) 00015-4.
15. Shekhawat NS, Niziol LM, Sharma SS, Joseph S, Robin AL, et al. (2020) The utility of routine fundus photography screening for posterior segment disease: A stepped-wedge, cluster-randomized trial in south india. Ophthalmology 27: S0161-6420 (20) 31120-9.
16. Rajendrababu S, Gupta N, Vijayakumar B, Kumaragurupari R, Krishnadas SR (2014) Screening first degree relatives of persons with primary open angle glaucoma in india. J Curr Glaucoma Pract 8: 107-112.
17. Kavitha S, Zebardast N, Palaniswamy K, Wojciechowski R, Chan ES, et al. (2014) Family history is a strong risk factor for prevalent angle closure in a south Indian population. Ophthalmology 121: 2091-2097.
18. Susanna R Jr, De Moraes CG, Cioffi GA, Ritch R (2015) Why do people (Still) go blind from glaucoma? Transl Vis Sci Technol 4: 1.
19. Nordstrom BL, Friedman DS, Mozaffari E, Quigley HA, Walker AM (2005) Persistence and adherence with topical glaucoma therapy. Am J Ophthalmol 140: 598-606.
20. Lee BW, Sathyan P, John RK, Singh K, Robin AL (2008) Predictors of and barriers associated with poor follow-up in patients with glaucoma in south India. Arch Ophthalmol 126: 1448-1454.
21. de Moraes CG, Juthani VJ, Liebmann JM, Teng CC, Tello C, et al. (2011) Risk factors for visual field progression in treated glaucoma. Arch Ophthalmol 129: 562-568.
22. Krishna U, Venkatesh R, Srinivasan K, Odayappan A, Robin AL (2021) Letter to the editor: Glaucoma surgery during the COVID-19 pandemic in Italy: How novel coronavirus has changed the surgical management of glaucoma patients. J Glaucoma 30: e187-e188.
23. Dada T, Mittal D, Mohanty K, Faiq MA, Bhat MA, et al. (2018) Mindfulness meditation reduces intraocular pressure, lowers stress biomarkers and modulates gene expression in glaucoma: A randomized controlled trial. J Glaucoma 27: 1061-1067.
24. Beckers HJ, Kinders KC, Webers CA (2003) Five-year results of trabeculectomy with mitomycin C. Graefes Arch Clin Exp Ophthalmol 241: 106-110.
25. Anand A, Negi S, Khokhar S, Kumar H, Gupta SK, et al. (2007) Role of early trabeculectomy in primary open-angle glaucoma in the developing world. Eye (Lond) 21: 40-45.