Original Research Article

Relevance of mandatory glaucoma screening in all patients from outreach cataract camps referred to a base hospital for cataract surgery

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ABSTRACT

Background: Glaucoma is the first cause of irreversible blindness and second leading cause of visual loss in the world. The purpose of this study was to conduct mandatory glaucoma screening and to find out the prevalence of glaucoma, in all patients referred for cataract surgery to a base hospital.

Methods: A retrospective analysis was conducted of all patients referred from rural screening camps to base hospital for cataract surgery. Medical records of 5024 consecutive patients referred to base hospital from the month of January to June 2019 were reviewed. All these 5024 patients underwent comprehensive ophthalmic and systemic examination. Those patients in which glaucoma was suspected, were referred to glaucoma clinic for further evaluation.

Results: Total 5024 patient's records were analysed retrospectively. The mean age of the participants was 57.2±8.149 ranged from 40-95 years and average age of patients having cataract with glaucoma was 61.3±9.423. Total patients of glaucoma with cataract were 188 (3.7%). The prevalence of primary open angle glaucoma (POAG) and Primary angle closure glaucoma (PACG) was 1.69% and 1.17% respectively while secondary glaucoma was found in 0.88% of the patients. The prevalence of ocular hypertension, PAC and PACS was 0.33%, 0.29% and 0.83% respectively.

Conclusion: The prevalence of glaucoma in this study was 3.7% of those planned for cataract surgery. Therefore, mandatory glaucoma screening in all patients from outreach cataract camps would result in detection of a large number of those with undiagnosed glaucoma.

Keywords: Community outreach screening camp, Cataract, Glaucoma, Prevalence

INTRODUCTION

Aim of the study was to study the relevance of conducting mandatory glaucoma screening in all patients referred for cataract surgery to a base hospital, from rural outreach cataract screening camps.

Cataract accounts for 47.8% of global blindness, and 51% of this is in south Asia region including India.[1,2] The number of cataract surgeries performed per year is close to 4.86 million/year.[2,3] The number of cataract surgeries performed is steadily rising due to the efforts taken by national and international bodies and various nongovernment organizations pledged to eradicate the blindness caused by cataract.

Glaucoma is the second most common cause of blindness, affecting 66 million people worldwide.[4] Glaucoma is also responsible for significant ocular morbidity in India. However, more than 90% of glaucoma cases in India remain undiagnosed until very late, where irreversible damage has already occurred.

The current detection rates for glaucoma, in urban population is 7.8% but in rural population it is only 1%. This disparity in detection rates may be due to lack of awareness among the general population, Relatively asymptomatic nature of the disease and absence of robust screening programs.[5,6,7]

This is a matter of concern, as the majority of Indian population (65%) resides in rural areas.[8] In a systematic meta-analysis done in 2014, the estimated global prevalence of glaucoma was reported as 3.54%.[9] Asians accounted for approximately half of the total cases of glaucoma worldwide, with the studies showing the prevalence of glaucoma between 0.94% to 4.73% among them.[10,11] With the increase in longevity of the ageing population, the prevalence of glaucoma is also expected to rise further. India, being the second most populous country in the world, is going to face a huge economic burden due to the irreversible blindness caused by glaucoma.

The current estimated prevalence of glaucoma in India is reported to be 11.9 million.[12] This rate is not the same at every place, due to considerable variation among different populations, ethnicity and subgroups. These prevalence rates have been derived from populations-based studies, which were conducted a long time ago and there is a paucity of recent, large scale studies directed towards the rural population in India. This study was conducted with the objective of finding the prevalence of glaucoma among adults aged 40 years and above who were referred to a tertiary eye care hospital from cataract screening outreach camps.

METHODS

A retrospective analysis was conducted of all the patients referred from rural screening camps to base hospital for cataract surgery. The study was initiated after approval from the institutional ethics and research advisory committee. Medical records of 5024 consecutive patients referred to base hospital from the month of January up to June 2019 were reviewed.

Resident doctors and trained optometrists performed the initial ophthalmic examination at screening camp site. Ophthalmic examination at the camp site mainly included visual acuity, torch light examination and Intraocular pressure (IOP) by Schiotz indentation tonometer. Patients having cataract and increased IOP were referred to base hospital. All the patients referred to base hospital underwent a comprehensive ophthalmic and systemic examination which included detailed history taking, visual acuity, slit lamp evaluation, IOP measurement by rebound tonometry (iCare), fundus evaluation, nasolacrimal sac syringing, blood pressure assessments and random blood sugar examination.

The patients, who on initial workup were suspected to have glaucoma, were referred to glaucoma clinic for further evaluation. In all the glaucoma suspects, a meticulous slit lamp examination was done and peripheral anterior chamber depth (PACD) was assessed on the basis of van Herick's grading system. IOP measurement was repeated by Goldman applanation tonometry, gonioscopy was performed by Sussman 4 mirror goniolens and Shaffer grading system was used for anterior chamber angle grading, followed by dilated stereoscopic optic disc examination with slit lamp and + 78 D lens. In hazy or scarred corneas Schiotz indentation tonometer was used. Those subjects who were having either normal IOP (<21 mmHg) with glaucomatous disc changes or increased IOP (>21 mmHg) with or without glaucomatous disc changes underwent visual field examination using automated perimeter (SITA standard testing strategy, on Zeiss-Humphrey Visual Field Analyzer). On post op day-1, fundus evaluation was done in mature or hyper mature cataracts to assess the optic disc status.

All the patients of age more than 40 years and who underwent complete ophthalmic evaluation were included in this study and patients with incomplete examination and incomplete records were excluded. Statistical analysis was carried out using SPSS 14.0 for Windows (SPSS Inc., Chicago, IL).

Diagnostic definitions

Significant disc changes

Vertical cup disc ratio (C:D)>0.6 in either eye, asymmetry of cup disc ratio of more than 0.2 and Other disc changes like polar notch, haemorrhages on or near the disc, thinning of neuro retinal rim.

IOP changes

Pressure of >21 mmHg in either eye and difference of more than 6 mmHg pressure in both eyes.

Glaucomatous field defect

Anderson criteria was used which includes a cluster of 3 or more non-edge points in a location typical of glaucoma, all of which are depressed on the pattern deviation plot at p<5% level and one of which is depressed at a p<1% level on consecutive fields.

Glaucoma suspect

Pressure of >21 mmHg in either eye or a difference of more than 3 mm Hg, vertical cup disc ratio >0.5 in either eye or asymmetry of cup disc ratio and Other glaucomatous disc changes.

Glaucoma diagnosis

Any two of the three features- High IOP, Significant glaucomatous disc changes and Glaucomatous field defect.

RESULTS

Total 5024 patient's records were analysed retrospectively. Among the total of 5024 patients, 3051 (60.72%) were males and 1973 (39.27%) were females. The mean age of the participants was 57.2±8.149 ranged from 40-95 years and average age of patients having cataract with glaucoma was 61.3±9.423. Total glaucoma patients with cataract were 188 (3.7%).

Table 1: Age and IOP distribution.

Patients	Mean age (years)	Mean IOP (mmHg)
Cataract patients	57. 2±8.149	14.42±2.89
Glaucoma+ cataract patients	61.3±9.423	23.90±8.83 (P<0.001)

Mean IOP observed among 5024 patients was 14.42±2.89 mmHg and mean IOP in glaucoma patients with cataract was 23.90±8.83 mmHg. Observed 17 (0.33%) patients of ocular hypertension and 15 (0.29%) patients of

primary angle closure, in this study and they were categorized as pre-glaucoma patients without glaucomatous disc changes. About 67% of eyes among all patients, had a CD ratio equal or less than 0.3. In 281 eyes a CD ratio of more than 0.6 was recorded and out of these 145 patients had raised IOP with or without glaucomatous visual field defect, fulfilling the criteria of glaucoma. The mean CD ratio among the glaucomatous and non-glaucomatous patients was 0.59±0.16 and 0.34±0.07 respectively. Total 17 eyes were having glaucomatous optic atrophy.

Table 2: Demographic profile of study participants.

Variable	Participant	Frequency	Percentage (%)
Age (years)	40- 49	1801	35.84
	50-59	1271	25.29
	60-69	1199	23.86
	>70	753	14.98
Total		5024	
Sex	Male	3051	60.72
	Female	1973	39.27
Total		5024	

Table 3: IOP distribution, cup to disc ratio and anterior chamber depth of the study population.

Variable		Right eye (%)	Left eye (%)
IOP (mmHg)			
5-10		1006 (20.02)	712 (14.17)
11-15		2937 (58.4)	2993 (59.57)
16-20		924 (18.39)	1148 (22.85)
21-25		110 (2.18)	111 (2.20)
26-30		14 (0.27)	23 (0.45)
31-35		2 (0.03)	7 (0.13)
36-40		15 (0.29)	8 (0.15)
46-50		16 (0.31)	22 (0.43)
Total		5024	5024
Cup to disc ratio			
0.2		672 (13.37)	530 (10.54)
0.3		2705 (53.84)	2753 (54.79)
0.4		1107 (22.03)	1210 (24.08)
0.5		253 (5.03)	269 (5.35)
0.6		142 (2.82)	126 (2.50)
0.7		97 (1.93)	92 (1.83)
0.8		41 (0.81)	34 (0.67)
Glaucomatous optic atrophy		7 (0.13)	10 (0.19)
Total		5024 (100)	5024 (100)
PACD (van Herick's grading)			
Grade	PACD in peripheral corneal thickness (PCT)	Right eye (%)	Left eye (%)
Grade 1	< 1/4	23 (0.45)	16 (0.31)
Grade 2	1/4	650 (12.93)	503 (10.01)
Grade 3	1/4 to 1/2	1440 (28.66)	1435 (28.56)
Grade 4	≥ PCT	2911 (57.94)	3070 (61.10)
Total		5024 (100)	5024 (100)

Most of the eyes had a normal anterior chamber depth while 16.19% of them had shallow angle with 15 patients classified as isolated primary angle closer without glaucomatous changes. The prevalence of POAG and PACG was 1.69% and 1.17% respectively while secondary glaucoma was found in 0.88% of the patients. Mean age of POAG and PACG patients was 61.99±8.606 years and 61.20±9.143 years respectively. Mean IOP in POAG and PACG patients was 23.53±5.455 mmHg, and 29.70±15.612 mmHg, respectively. The prevalence of ocular hypertension, PAC and PACS was 0.33%, 0.29% and 0.83%, respectively.

Table 4: Type of glaucoma among the study population.

Type of glaucoma	Prevalence (%)	95% CI
POAG	85 (1.69)	1.35-2.09
PACG	59 (1.17)	0.9-1.5
Secondary glaucoma	44 (0.88)	0.64-1.17
Total	188 (3.7)	3.23-4.30
Pre-glaucoma		
Ocular hypertension	17 (0.33)	0.2-0.54
Primary angle closure	15 (0.29)	0.17-0.49

DISCUSSION

This study was done to estimate the prevalence of glaucoma among the rural population referred for cataract surgery from rural outreach screening camps to a tertiary eye care hospital in Uttar Pradesh. The overall prevalence of glaucoma was found to be 3.7% (95% CI: 3.23-4.30). Similar studies from other parts of India show a prevalence of 2.3-4.7%.[11,13] Very few studies have been reported from north India but no study till now in north India assessed the glaucoma in outreach camp patients, who basically attend these camps for cataract surgery unaware of their glaucoma status. A community-based study from Agra, reported prevalence of 4.2%, while an OPD based study from Kashmir also reported a prevalence of 4%, almost similar to this study findings.[14,15] A study from central India reported slightly lower rates with a prevalence of 3.7%, while a large study from Tamil Naidu reported a prevalence of 2.6%.[16,17] This study was compared with the findings of the Chennai Glaucoma Study (CGS) and Andhra Pradesh Eye Disease Study (APED) conducted in India and results are as under, show in table 5.

These comparisons show that glaucoma is more prevalent in the northern part of India, which has to be studied by a large multi-centric community-based study. When compared to the studies in other parts of world, the prevalence of glaucoma was found more or less similar in these parts of the world and varied from 0.94% in study from Nepal to 13.8% among US citizen but none of these studies were done in the population of rural or semi urban patients who attended these outreach camps considering cataract and refractive error as major cause of diminution of vision.[10,17]

Table 5: Comparison of prevalence.

Types of Glaucoma	CGS (RUR) (n=3924) (%)	APEDS (RUR) (n=2790) (%)	Study (RUR) (n=5024) (%)
POAG	1.62	1.60	1.69
PACG	0.87	0.88	1.17

A study among the ethnic Indian living in Singapore reported glaucoma prevalence of 1.95%.[19] A systematic meta-analysis done in 2014, estimated the global prevalence of glaucoma to be 3.54%.[9] The prevalence of glaucoma in this study was among the higher side in comparison to earlier studies. Thus, comparing the prevalence of glaucoma is difficult as differences are seen in definitions, methodology, expertise of the measurer, diagnostic equipment, while few researches have pointed out towards genetic and environmental predisposition of glaucoma.[20]

Few studies have reported minimal awareness of glaucoma in general population with low rates of treatment.[21, 22] The health education and regular screening for these high-risk population is very important to prevent blindness. Regular counselling and adherence to the treatment of the patients who have been diagnosed having glaucoma is an essential as a part of comprehensive primary ophthalmic care.

The different subtypes of glaucoma have varied prevalence in different ethnic groups. POAG predominates in Caucasians, while in Eskimos, the PACG makes the major subtype of primary glaucoma.[23] The Asian population had the prevalence of PACG in between Eskimos and Caucasians as they have the tendency of a shallow anterior chamber.[23]
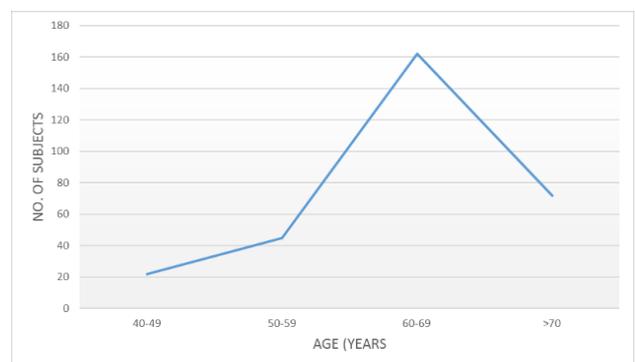
Figure 1: Prevalence of glaucoma increases with the age.

In this study we observed the prevalence of POAG, PACG and OHT as 1.69%, 1.17% and 0.33% respectively while secondary glaucoma was found in 0.88% of the patients. In this study, phacomorphic glaucoma was most common type of secondary glaucoma which highlights significance of early cataract surgery. We observed a mean IOP of 14.42±2.89 mmHg among the cataract only patients, while 23.90±8.83 mmHg among glaucoma patients with cataract. Mean CD ratio was found out to be 0.34, which increased to 0.59 among patients having glaucoma, were similar to study from South India.[11] Most of the patients had CD ratio equal or less than 0.3. In 281 eyes a CD ratio of more than 0.6 was recorded and out of these 145 participants had raised IOP with or without glaucomatous visual field defect, fulfilling the criteria of glaucoma.

Merits and limitations

Merits of the study were like**:** Opportunistic screening, ability to detect glaucoma in outreach camp patients and who are unaware of their glaucoma status.

Limitations of the study were like**:** Retrospective study, data only for 6 months were analysed and only cataract screening.

CONCLUSION

For many people in the rural areas the only point of contact with the eye care system is when they seek or are "screened" for cataract surgery. The prevalence of glaucoma in this study was 3.7% of those planned for cataract surgery. If these numbers are similar for the rest of the country this approach would result in detection of a large number of those with undiagnosed glaucoma. Comprehensive eye examination is mandatory for all the patients of outreach camps to detect the glaucoma, a leading cause of irreversible blindness.

REFERENCES

1. World Health Organisation. Global initiative for the elimination of avoidable blindness: An informal consultation. Geneva: WHO; 1997. Available at: https://apps.who.int/iris/handle/10665/63748.
2. Murthy G, Gupta SK, John N, Vashist P. Current status of cataract blindness and Vision 2020: the right to sight initiative in India., Indian J Ophthalmol. 2008;56(6):489-94.
3. Arvind S, Haripriya A, Sumara Taranum BSl. Cataract surgery and intraocular lens manufacturing in India. Curr Opin Ophthalmol. 2018;19(1):60-5.
4. Sheng B, Law CB, Yeung KM. Characteristics and diagnostic profile of patients seeking dementia care in a memory clinic in Hong Kong. Int Psychogeriatr. 2009;21(2):392.
5. Dandona R, Dandona L, John RK, McCarty CA, Rao GN. Awareness of eye diseases in an urban population in southern India. Bulletin of the World Health Organization. 2001;79(2):96-102.
6. Brilliant GE, Lepkowski JM, Zurita B, Thulasiraj RD. Social determinants of cataract surgery utilization in south India. Arch Ophthalmol. 1991;109(4):584-9.
7. George R, Vijaya L, Arvind H, Baskaran M, Ramesh SV, Raju P. The Chennai glaucoma study: Prevalence and risk factors for glaucoma in cataract operated eyes in urban Chennai. Indian J Ophthalmol. 2010;58(3):243-5.
8. Rural Population (% of Total Population). World Bank. 18 May 2016. Retrieved 14 July 2020. Available at: https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS.
9. Tham YC, Li X, Wong TY, Quigley HA, Aung T, Cheng CY. Global prevalence of glaucoma and projections of glaucoma burden through 2040: a systematic review and meta-analysis. Ophthalmol. 2014;121(11):2081-90.
10. Sah R, Badhu B, Pokharel P, Thakur S, Das H, Panda A. Prevalence of glaucoma in Sunsari district of eastern Nepal. KUMJ. 2007;5(3):343-8.
11. Jacob A, Thomas R, Koshi SP, Braganza A, Muliyil J. Prevalence of primary glaucoma in an urban south Indian population. Indian J Ophthalmol. 1998;46(2):81-6.
12. George R, Ve RS, Vijaya L. Glaucoma in India: estimated burden of disease. J Glaucoma. 2010;19(6):391-7.
13. Dandona L, Dandona R, Srinivas M, Mandal P, John RK, McCarty CA et al. Open-angle glaucoma in an urban population in southern India: the Andhra Pradesh eye disease study. Ophthalmol. 2000;107(9):1710-9.
14. Awasthi P, Sarbhai KP, Banerjee SC, Maheshwari BB. Prevalence study of glaucoma in rural areas. Indian J Ophthalmol. 1975;23(1):1-5.
15. Wani AE, Keng MQ. Glaucoma scenario in Kashmir valley: a hospital-based study. IOSR J Dent Med Sci. 2019;18:8-14.
16. Palimkar A, Khandekar R, Venkataraman V. Prevalence and distribution of glaucoma in central India (Glaucoma Survey 2001). Indian J Ophthalmol. 2008;56(1):57-62.
17. Ramakrishnan R, Nirmalan PK, Krishnadas R, Thulasiraj R, Tielsch JM, Katz J, et al. Glaucoma in a rural population of southern India: The Aravind comprehensive eye survey. Ophthalmol. 2003;110(8):1484-90.
18. Lee PP, Feldman ZW, Ostermann J, Brown DS, Sloan FA. Longitudinal Prevalence of Major Eye Diseases. Arch Ophthalmol. 2003;121(9):1303.
19. Narayanaswamy A, Baskaran M, Zheng Y, Lavanya R, Wu R, Wong WL, et al. The Prevalence and

Types of Glaucoma in an Urban Indian Population: The Singapore Indian Eye Study. Investigat Opthalmol Vis Sci. 2013;54(7):4621.

20. Paul C, Sengupta S, Choudhury S, Banerjee S, Sleath B. Prevalence of glaucoma in Eastern India: The Hooghly River Glaucoma Study. Indian J Ophthalmol. 2016;64(8):578.

21. Krishnaiah S, Kovai V, Srinivas M, Shamanna B, Rao G, Thomas R. Awareness of glaucoma in the rural population of Southern India. Indian J Ophthalmol. 2005;53(3):205.

22. Vijaya L, George R, Paul PG, Baskaran M, Arvind H, Raju P, et al. Prevalence of Open-Angle Glaucoma in a Rural South Indian Population. Invest Ophthalmol Vis Sci. 2005;46(12):4461-7.

23. Jonas JB, Nangia V, Matin A, Sinha A, Kulkarni M, Bhojwani K. Intraocular pressure and associated factors: The central India eye and medical study. J Glaucoma. 2011;20(7):405-9.