Original Research Article

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A community based study of scenario of glaucoma in Aligarh, India

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ABSTRACT

Background: Glaucoma is the leading cause of irreversible blindness worldwide and is second only to cataracts as the most common cause of blindness overall. In the developing world, the prevalence of glaucoma is expected to rise even more dramatically as the population of adults has doubled within a span of few decades. So this study was done with an objective of finding out the prevalence of glaucoma among adults aged 40 years and above in the field practice area of the Department of Community Medicine, Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh.

Methods: A cross-sectional study was carried out for the duration of one year. A total of 680 persons were interviewed and examined by a trained ophthalmologist for detailed eye examination including visual acuity, refraction and slit-lamp bio-microscopy, intraocular pressure (IOP) by Keeler Pulsair non-contact tonometer confirm by applanation tonometry, gonioscopy, and dilated fundus examination after ruling out the risk of angle closure. Anderson criteria were used to diagnose glaucomatous visual field defect.

Results: In our study population, the IOP of the majority of population lied in 11-15 mm Hg with a mean IOP of 13.42±4.09 mmHg. In regard to optic disc examination, a cup to disc ratio of >0.6 was found in 35 eyes. According to the predefined criteria, a total of 31 subjects were diagnosed as glaucoma in either one or both eyes. The overall prevalence of glaucoma was found to be 4.6% (31/680), with the prevalence of primary open angle glaucoma, primary angle closure glaucoma, normotensive glaucoma and secondary glaucoma as 1.3%, 1.2%, 1.2% and 0.9% respectively.

Conclusions: The prevalence of glaucoma is quite high in an elder population of Aligarh. This should warrant more intensive activities, focusing not only on early diagnosis and management of glaucoma but also include strengthening preventive ophthalmic care.

Keywords: Glaucoma, Community based study, Elderly, IOP

INTRODUCTION

Glaucoma is the second most common cause of blindness worldwide.¹ In a systematic meta-analysis in 2014, the estimated global prevalence of glaucoma was reported as 3.54%.² 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.^{3,4} With the rapid increase in the ageing population, the prevalence is expected to rise.

India being the second populous country, the burden of glaucoma is expected to be high. The estimated prevalence of glaucoma cases in India is reported to be 11.9 million.⁵ This rate is not the same at every place, with varying prevalence among different populations and subgroups. These rates have been derived from populations based studies, which are very few among north Indian population. Considering the paucity of community glaucoma studies, this study was conducted with the objectives of finding out the prevalence of

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glaucoma among adults aged 40 years and above in the field practice are of the Department of Community Medicine, Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh.

METHODS

A community-based cross-sectional study was carried out among elderly population residing at field practice area of Rural Health Training Centre (RHTC) and Urban Health Training Centre (UHTC), Department of Community Medicine, JN Medical College, AMU, Aligarh.

Further JN Medical College, AMU, Aligarh, also runs the one of the largest government Ophthalmology Institute in India. Incidentally, Aligarh is also one of the districts of the state of Uttar Pradesh, which is the most populated state of the country, the population being 5th highest in the world (when treated as a country). The study was done for a period of one year from July 2015 to June 2016.

Sample size

The sample size was calculated by the formula of determining the sample size of cross-sectional studies.

$$N = \frac{Z^2 P(100 - P)}{d^2}$$

With the assumption of 3.5% as prevalence of glaucoma based on prominent prevalence studies in India, which is also the estimated global prevalence, and with absolute precision of 2% and 95% confidence interval and a design effect of two, the sample size came out to be 649. Taking into account of non-responses, the final sample size was increased to 700. Probability proportion to size (PPS) systematic random sampling was done to draw the desired sample from each area with 410 from rural and 290 from urban.

Selection criteria

The inclusion criteria included people aged 40 years and above, resident of household registered with UHTC and RHTC and who will give consent for interview and examination.

Those who did not give the consent and severely ill patients were excluded from the study.

Operational definition

High intraocular pressure

- Pressure of >21 mm Hg in either eye.
- Difference of more than 6 mm Hg pressure in both eyes.

Significant disc changes

- Vertical cup disc ratio >0.6 in either eye.
- Asymmetry of cup disc ratio of more than 0.2.
- Other disc changes like polar notch, hemorrhages on or near the disc, thinning of neuro retinal rim.

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 mm Hg 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.
- Other disc changes.

Glaucoma diagnosis

Any two of the three features

- High intraocular pressure.
- Significant disc changes.
- Glaucomatous field defect.

Study procedure

The data was collected using a predesigned and pretested questionnaire. The questionnaire consists of complaints related to eye, history of glaucoma, along with sociodemographic variable. Socio-economic status was assessed by Modified B. G. Prasad classification, 2016. 11 A preliminary eye examination of all the participants was conducted at their home which includes visual acuity by Landort 'C' chart, the refractive status of eye determined by using +1 D lens and intraocular pressure measured using Keeler 'Pulsair easy eye' non-contact tonometer. This was followed by fundus examination by direct ophthalmoscope to assess glaucomatous optic disc changes. Those subjects in which glaucoma was suspected or whose uncorrected visual acuity (UCVA) was <3/60, they were asked to report to ophthalmology OPD at RHTC/UHTC for further evaluation. In the glaucoma suspect subject a detailed visual acuity and thorough slit lamp examination was done. A repeat recording of intraocular pressure (IOP) by Appasamy applanation tonometer followed by dilated stereoscopic optic disc examination with Appasamy slit lamp by Volk's +78 D lens. If cornea was hazy and mires are not seen by applanation or non-contact tonometer, Reister Schiotz indentation tonometer was used. The examination of irido-corneal angle with the help of gonioscope was done to know the shallowness of angle in all glaucoma suspects.

Subjects those were having either normal IOP (<21 mm Hg) with glaucomatous disc changes or increased IOP (>21 mm Hg) with/without glaucomatous disc changes were referred to tertiary centre for further visual field examination using automated perimeter (24-2 SITA standard, Zeiss-Humphrey Visual Field Analyzer) and for measurement of central corneal thickness. Disinfection and calibration of all the instrument was done on regular interval.

Ethical considerations

The study was initiated after approval from the Institutional Ethics and Research Advisory Committee, Faculty of Medicine, Aligarh Muslim University, Aligarh. Informed consent was taken from the subjects before the study. They were assured that the personal information received would be kept confidential. Health education and adequate counselling were provided to all the subjects. If any subject was found to have glaucoma or any other ailment, adequate treatment and referral to JN Medical College and Hospital for further management.

Statistical analysis

Data were tabulated and analysed by using SPSS ver. 21. 12 Descriptive data were presented as frequency, mean, percentage and standard deviation. The 95% confidence intervals for proportions were calculated using the Agresti-Coull method. 13

RESULTS

Among the total 700 patients selected, only 680 patients completed the whole questionnaire and were finally analyzed as 20 participants refused or dropout before the complete examination and were excluded from the study. The final analysis was done on 281 urban and 399 rural participants.

Socio-demographic and clinical characteristics

Among the total of 680 study participants, 267 (38.3%) were males and 413 (60.7%) were females. The mean age of the participants was 55.0±11.56 years ranged from 40-102 years. The majority of participants were in the age group 40-50 years. Majority of them were married (80.0%) and Hindu (54.0%) by religion. The educational status of the study population was very poor, with more than half of them (63.8%) being illiterate. The study population consisted mostly of housewives 392 (57.6%) and only 237 (34.8%) were employed, leaving 51 (7.5%) unemployed or retired. Majority of the participants belonged to lower socio-economic classes with 329 (48.4%) and 277 (33.4%) in class V and class IV respectively (Table 1).

Ocular hypertension, AC and CD ratio

Mean IOP observed among individual 1360 eyes was found to be 13.61±4.17 mm Hg, with a median of 13 mmHg and the interquartile range of 11 to 15 mmHg. The majority of eyes were having IOP in between 25th and 75th quartile, i.e., 11-15 mmHg. Mean IOP among the glaucomatous and non-glaucomatous population was 20.24±10.75 and 13.23±3.03 mm Hg respectively. We also observed three case of isolated ocular hypertension without glaucomatous changes. Majority of eyes have normal anterior chamber depth while 29% of them had shallow angle with two subjects classified as isolated primary angle closer without glaucomatous changes. The fundus was visible in 1269 eyes and mean CD ratio observed in study eyes was 0.335±0.095. About 66% of eyes had a CD ratio of equal or less than 0.3, while 35 eyes had >0.6, which was taken as the criteria of significant disc changes in our study. The disc of three patients was having optic atrophy. The mean CD ratio among the glaucomatous and non-glaucomatous population was 0.577±0.16 and 0.321±0.07 respectively.

Table 1: Socio-demographic profile of study participants.

Variables		Frequency	%
Residence	Urban	281	41.3
	Rural	399	58.7
Age (in years)	40-49	244	35.9
	50-59	172	25.3
	60-69	162	23.8
	>70	102	15.0
Sex	Male	267	39.3
	Female	413	60.7
Religion	Hindu	367	54.0
	Muslim	313	46.0
Marital Status	Married	544	80.0
	Devoiced/separated	1	0.1
	Widowed	135	19.9
Education	Illiterate	434	63.8
	Primary	90	13.2

Continued.

Variables		Frequency	%
	Secondary	128	18.8
	Graduation and above	28	4.1
Occupation	Unemployed/retired	51	7.5
	Unskilled and semi- skilled	130	19.1
	Skilled/clerical/shop/farm	107	15.7
	House wife	392	57.6
Social status	I	8	1.2
	II	38	5.6
	III	78	11.5
	IV	227	33.4
	V	329	48.4

Table 2: Type of glaucoma among the study population.

Type of glaucoma	Prevalence	95% CI
Primary open angle glaucoma (POAG)	9 (1.3)	0.7-2.5
Primary angle closure glaucoma (PACG)	8 (1.2)	0.6-2.4
Normotensive glaucoma (NTG)	8 (1.2)	0.6-2.4
Secondary glaucoma	6 (0.9)	0.4-2.0
Total	31 (4.6)	3.2-6.4
Pre-glaucoma		
Ocular hypertension	3 (0.4)	0.1-1.4
Primary angle closure	2 (0.3)	0.1- 1.1

Prevalence of glaucoma

After a screening by non-contact tonometry, followed by applanation tonometry along with optic disc examination by +78 D stereoptic lens and visual field examination, we observed a prevalence of 4.6% (31/680) of glaucoma in our study participants. Majority of these were unaware of their glaucoma disease while nine patients (29.0%) were chronic case of glaucoma, although only three of them were taking anti-glaucoma medication while two had undergone trabeculectomies.

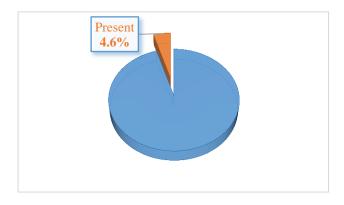


Figure 1: Prevalence of glaucoma among the study population.

Prevalence of subtypes of glaucoma

About equal distribution of type of glaucoma, i.e., POAG, PACG and NTG were observed in our study participants. The prevalence of POAG and PACG was 1.3% and 1.2% respectively while NTG and secondary glaucoma was found in 1.2% and 0.9% of the patients. Among the secondary glaucoma, phacomorphic glaucoma was most common type.

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	136 (20.0)	96(14.1)
11-15	397(58.5)	404(59.6)
16-20	125(18.4)	155(22.9)
21-25	15 (2.2)	15(2.2)
26-30	2(0.3)	3(0.4)
31-35	0(0.0)	1(0.1)
36-40	2(0.3)	1(0.1)
46-50	2(0.3)	3(0.4)
Total	679(100)	678(100)
Cup to disc ratio		
0.2	85 (13.3)	67(10.5)
0.3	342(53.8)	348(54.8)
0.4	140(22.0)	153(24.0)
0.5	32(5.0)	34(5.3)
0.6	18(2.8)	16(2.5)
0.7	12(1.9)	11(1.7)
0.8	5(0.8)	4(0.6)
Glaucomatous optic atrophy	1(0.1)	2(0.3)
Total	635(100.0)	635(100.0)
Anterior chamber depth		
Normal	394 (57.9)	415 (61.1)
Shallow	195 (28.8)	194 (28.6)
Deep	88 (12.9)	68 (10.0)
Collapsed	3 (0.4)	2 (0.3)
Total	680 (100)	679 (100)

DISCUSSION

The study was done to estimate the prevalence of glaucoma among the elderly population of Aligarh. For this, a community-based study was done in the field practice area of the department, with participants from both rural and urban by applying probability proportionate to size. The overall prevalence of glaucoma was found to be 4.6% [95% CI: 3.2-6.4].

Previous researchers have also studied glaucoma, but only a few have conducted their research at the community level. The prevalence of glaucoma in community and OPD based studies has varied results. The studies from various part of India reported a prevalence of 2.3-4.7%. While many studies were done in the South and East India, very few are reported from North India. A community-based study from Agra, although a very old, reported a similar prevalence of glaucoma of 4.2%, while an OPD based study from Kashmir also reported a prevalence of 4% similar to our study findings. ^{14,15} Although slightly lower rates were observed from Central India with a reported prevalence of 3.7 %, while a large study from Tamil Naidu reported a prevalence of 2.6%. 16,17 These findings lead us to the hypothesis that glaucoma is more prevalent in the northern part of India, which has to be studied by a large multi-centric community-based study. The prevalence of glaucoma is more or less similar in other parts of the world. It varied from 0.94% in study from Nepal to 13.8% among US citizen.^{3,18} 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%.² The prevalence of glaucoma in our 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, the expertise of measurer, diagnostic equipment, while few researches have pointed out towards genetic and environmental predisposition of glaucoma.²⁰

Although we observed a moderately high prevalence of glaucoma in our study population, point to take note is that about one-fourth patients had shallow AC chamber with two subjects of isolated primary angle closer, along with three case of isolated ocular hypertension which is considered risk factor for as future PACG and POAG respectively. We also noticed that majority of the patients were unaware of their disease, and those who known that they were having glaucoma, half did not opt for treatment. The minimal awareness of glaucoma in general population with low rates of treatment have been documented earlier. ^{21,22} These highlight the importance of health education and regular screening for these high-risk population as an important component of preventive ophthalmic care. A regular counseling of those who have been documented with glaucoma for their treatment adherence is also equally essential as a part of comprehensive primary care.²

In regard to the subtype of glaucoma, the prevalence varies from the different ethnic group. The Caucasians population have predominantly POAG, while in eskimos, the PACG makes the major subtype of primary glaucoma.²⁴ Among the Asian population, the prevalence of PACG is in between Eskimos and Caucasians as they have the tendency of a shallow anterior chamber.²⁴ We observed a uniform distribution of various type of glaucoma, with POAG, PACG and NTG in 1.3%, 1.2 % and 1.2% of the population respectively while secondary glaucoma was found in 0.9% of the patients. This finding translated to the 1.1:1 ratio of POAG to PACG, although most studies among Indian subcontinent have documented that the POAG is predominant subtype, with a prevalence of POAG varying from 1.26-4.32% and PACG in 0.15-1.11% among various Indian sub population. 4,5,8-10,17,20,25 glaucoma Secondary observed in few participants which was similar to the rates observed in previous studies. 16,26 We observed phacomorphic glaucoma as most common type of secondary glaucoma which highlight significance of early cataract surgery.

We observed a mean intraocular pressure (IOP) of 13.61±4.17 mmHg among the study population, while 20.24±10.8 mmHg among glaucoma patients. Similar IOP was observed among Central India, although studies from South India observed slightly higher IOP among the general population. 4.22.27 Mean CD ration was found out to be 0.36±0.1, which increased to 0.58±0.16 among patients having glaucoma, which are similar to study from South India. 4 Majority of population were having CD ratio equal or less than 0.3, indicating a normal fundus, while 31 eyes a CD ratio of more than 0.6 was recorded and out of these 31 participants had raised IOP and/or filed defect, fulfilling the criteria of glaucoma.

CONCLUSION

With vision 2020 going to conclude soon, and with about two decades of work to eliminate glaucoma, the high prevalence of glaucoma in our study population should warrant more intensive activities. Apart from strengthening preventive ophthalmic care in form of health education and regular screening for these highrisk, the strategies for early diagnosis and management of glaucoma should be developed and advocated so as to enhance patient-centric care and prevent one of the major causes of avoidable blindness.

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