

A population based survey of the prevalence and types of glaucoma in rural West Bengal: the West Bengal Glaucoma Study

A Raychaudhuri, S K Lahiri, M Bandyopadhyay, P J Foster, B C Reeves, G J Johnson

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Aim: To determine (i) the prevalence of glaucoma in people aged ≥ 50 years, (ii) the proportions of different types of glaucoma, (iii) the distributions of intraocular pressure and vertical cup disc ratio.

Method: Population based prevalence survey in rural West Bengal. People aged ≥ 50 years in randomly selected villages in 24 Parganas South district. The main outcome measures were diagnosis of glaucoma, based on criteria described by the International Society for Geographic and Epidemiological Ophthalmology.

Results: 1594 people aged ≥ 50 years were enumerated in nine villages; 1324 (83.1%) were surveyed and 1269 people adequately examined. 42 definite cases of glaucoma were identified, with prevalence increasing from 2.7% (95% CI 1.7 to 3.7) in people aged 50–59 years to 6.5% (95% CI 0.0 to 14.1) in those aged ≥ 80 years. The age standardised estimate for the prevalence of all glaucoma in people aged ≥ 50 years was 3.4%. Only three cases of primary angle closure glaucoma (PACG) were identified, giving a crude ratio of primary open angle glaucoma (POAG) to PACG of more than 10:1. Three people with glaucoma were blind in one eye but none was blind in both eyes.

Conclusion: Compared to other surveys of glaucoma in India, the age standardised prevalence observed was less than in Hyderabad, but similar to Tamil Nadu and Dhaka. The ratio of POAG to PACG was much higher than found previously, suggesting that PACG may be less prevalent in Bengalis than in Indian populations living in south India. The authors conclude that ophthalmic services in West Bengal should focus on detecting POAG. Since there is still no satisfactory method of screening for POAG, there is no alternative to case detection (opportunistic screening) in eye clinics.

See end of article for authors' affiliations

Correspondence to:
Dr B C Reeves, Department of Public Health and Policy, London School of Hygiene and Tropical Medicine, London WC1E 7HT, UK; barney.reeves@lshtm.ac.uk

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Glaucoma has been established, in most regions of the world as well as globally, as the second most frequent cause of blindness after cataract.¹ According to this World Health Organization model, based on the most recent available data, glaucoma accounted for 12.3% of blindness in 2002. The authors concluded that countries should be encouraged to carry out periodic population based surveys of the magnitude and causes of visual impairment, particularly in densely populated countries, and countries in regions where data are scarce.

Until the last few years, no robust population based data for glaucoma have been available from India. It has generally been assumed from clinic studies that the proportion of primary open angle glaucoma (POAG) to primary angle closure glaucoma (PACG) is approximately equal.² However, the complex patterns of migration across India,³ contributing to marked ethnic differences between different regions, may mean that both the overall prevalence and the proportion of PACG may vary from one part of the country to another.

A population based study of 972 people aged 30–60 years suggested that PACG is about five times as common as POAG in Vellore, Tamil Nadu.⁴ A larger study of an urban population in Hyderabad, Andhra Pradesh, found that the prevalence of POAG was more than twice that for PACG.⁵ A recent comprehensive survey in Madurai, also in Tamil Nadu, gave an estimate of the prevalence of POAG three times that for PACG.⁷ These three reports come from southern India. No epidemiological data have been available for glaucoma in eastern India. Recently, however, data have been published from the Bengali population of Dhaka in Bangladesh.⁸

This paper reports a survey of a rural population in West Bengal. The objectives were to determine: (i) the prevalence

of glaucoma in people aged 50 years or more, (ii) the proportion of different types of glaucoma, (iii) the distribution of intraocular pressure (IOP) and vertical cup disc ratio (VCDR).

METHODS

Study population

The district of 24 Parganas South in West Bengal was chosen for the survey because there were existing, well established community links because of a child health programme (ICDS). These links were considered likely to improve local collaboration and participation. Three of 30 ICDS blocks in the district within a distance of 50 kilometres from the Regional Institute of Ophthalmology, Calcutta, were chosen by simple random selection. Three of about 100 villages in each block were randomly selected. All people aged 50 years and over in these villages were enumerated and considered eligible for inclusion in the study. For each household, the name, age, sex, and number of family members were recorded. A history was taken for each family member, with particular attention to the duration of dimness of vision, if any; symptoms of painful dimness of vision with red eyes, or of seeing halos around lights; any previous surgical procedures undertaken on the eyes; trauma; past glaucoma diagnosis, and if any family member suffered from glaucoma.

Clinical examination

Visual acuity was recorded using a Snellen distance vision chart at 6 metres. An ophthalmologist carried out refraction

Abbreviations: IOP, intraocular pressure; PACG, primary angle closure glaucoma; PMOA, paramedical ophthalmic assistant; POAG, primary open angle glaucoma; VCDR, vertical cup disc ratio

Table 1 Age and sex distribution of subjects attending for clinical examination (n = 1324)

Age group	Males in sample (not able to examine adequately)	% of sample	% in population (n = 777)	Females in sample (not able to examine adequately)	% of sample	% in population (n = 817)
50–59 years	318 (4)	50.6	51.0	319 (5)	45.9	45.0
60–69 years	196 (4)	31.2	30.8	233 (16)	33.5	32.8
70–79 years	93 (9)	14.8	14.5	111 (9)	16.0	15.8
80+ years	22 (1)	3.5	3.7	32 (7)	4.6	6.4
Total	629 (18)	100.0	100.0	695 (37)	100.0	100.0

and recorded the corrected visual acuity. Visual field examination was carried out by a paramedical ophthalmic assistant (PMOA) using a static, semi-automated (computerised) visual field analyser (Henson CFA 3200, Tinsley, Newbury, UK). An automated threshold related single stimulus suprathreshold program was used to check 68 points in the central 25 degrees in each eye. If a test location was not seen, the stimulus intensity was automatically increased in stages from 0.5 to 0.8 and ultimately to 1.2 log units. The visual field was classified as normal if no defect was observed. The central field analyser itself classified visual field results as normal/suspect/defect; these results were recorded for correlation with the other clinical findings.

Oblique flash light test, examinations under slit lamp, tonometry, fundus photography, and interpretation of the findings for the purpose of diagnosis were done by one of the authors (ARC). Any atrophic patch on the iris, signs of exfoliation, and the condition of the lens were noted. Tonometry was performed using a Goldmann applanation tonometer on the slit lamp; three readings were taken and the mean (the nearest whole number) was recorded as the IOP. Gonioscopy was carried out using a Goldmann two mirror gonio lens (Haag-Streit). The angle of the anterior chamber was graded according to Shaffer's angle grading system.⁹ Any peripheral anterior synechiae were noted. The iris profile and the insertion of the iris were noted according to Spaeth's system.⁹ The optic disc was examined after dilating each pupil with one drop of a mixture of tropicamide 0.8% and phenylephrine 5%. A +90D lens (Volk) was used at the slit lamp for biomicroscopy of the disc. A ratio of the longest vertical diameter of the cup to the longest vertical diameter of the disc was estimated as the VCDR for each eye.¹⁰ Any asymmetry of the VCDRs between the two eyes, the narrowest neuroretinal rim, any notching at the cup margin, disc pallor, and haemorrhage were noted. A red free light was used to check for any defect in the nerve fibre layer. The macula of each eye was examined with the same lens.

Fundus photography (Topcon Retinal camera TRC-50XT) was done routinely except in subjects where dense cataractous change in the lens prevented visualisation of the disc. One non-stereoscopic photograph and two paired stereoscopic photographs were taken for each eye using Kodachrome 100 ASA film.

Criteria for classification of glaucoma

We applied criteria for diagnosing glaucoma previously described by the International Society for Geographic and Epidemiological Ophthalmology (ISGEO), using "three levels of evidence"¹¹:

- a VCDR of 0.7 or greater or asymmetry between the right and left VCDRs of 0.2 or more, and a visual field defect consistent with glaucoma (an abnormal 68 point field test);
- a VCDR of 0.9 or greater in either eye or asymmetry between the right and left VCDRs of 0.3 or more, and a reliable field test result could not be obtained;

- an IOP greater than 26 mm Hg and visual acuity worse than 3/60, or evidence of previous glaucoma filtering surgery, when the optic disc could not be examined because of media opacity.

The VCDR and IOP criteria described above were based on the 97.5th and 99.5th percentiles for "hypernormals" in surveys described by Foster *et al.*,¹¹ rather than on the basis of the population sample studied in West Bengal. There were three reasons for this: (a) extreme percentiles are intrinsically unstable; (b) the study sample for the present survey was relatively small compared to the studies reviewed by Foster *et al.*¹¹; (c) the criteria for population based samples of hypernormals in different countries are similar,¹¹ despite some concern about variations in disc size affecting VCDR.¹²

Open angle glaucoma

In the presence of open anterior chamber angles, a patient was given a diagnosis of POAG if one or both eyes met any of the criteria outlined above, unless there was any other sign of retinal or optic nerve disease—for example, diabetes mellitus, branch or central retinal vein occlusion, or signs of pseudoexfoliation, trauma or pigment dispersion. If any of the latter signs were present, a diagnosis of secondary open angle glaucoma was made.

A diagnosis of suspected POAG was made in the presence of an open angle of the anterior chamber, a VCDR of 0.7 or more, or asymmetry between the right and left VCDRs of 0.2 or more without an associated definite visual field abnormality.

Angle closure

The presence of an occludable angle was the essential feature for diagnosing angle closure glaucoma, if one or both eyes met any of the criteria outlined above. An angle in which the pigmented trabecular meshwork was not visible throughout three quarters or more of the angle circumference in the primary position without manipulation or indentation was classified as occludable. In the absence of any other cause for angle closure, patients with an occludable angle meeting any of the criteria for glaucoma described above were diagnosed as having chronic PACG. Patients were diagnosed as having acute PACG if they had signs of past attack of acute angle closure on iris and lens surfaces, or if they reported a clear history of seeing a rainbow halo around light, sudden or intermittent attacks of painful red eye, and dimness of vision. If there were characteristic disc changes but no field changes in the presence of an occludable angle, a diagnosis of suspected PACG was made. Angle closure glaucoma associated with signs of other primary causes was classified as secondary angle closure glaucoma.

In addition to applying the ISGEO criteria described above to clinical findings, optic disc photographs and visual field assessments were reviewed by three ophthalmologists. As a result of this review, some patients with suspected glaucoma without definite field abnormalities were classified as probable cases of glaucoma—for example, when there was

Table 2 Profiles of the distributions of intraocular pressure (IOP) and vertical cup disc ratio (VCDR) among "hypernormals"—that is, people confirmed not to have glaucoma (n = 1170)¹¹ (and in the whole sample of people attending for examination, n = 1324)

	IOP right	IOP left	VCDR right	VCDR left	VCDR asymmetry*
Observations	1153 (1282)	1148 (1280)	1149 (1250)	1143 (1246)	1124 (1222)
Missing data	17 (42)	22 (44)	21 (74)	27 (78)	46 (102)
Mean	13.8 (14.0)	13.7 (13.8)	0.40 (0.42)	0.40 (0.42)	0.02 (0.03)
Median	13 (14)	13 (14)	0.4 (0.4)	0.4 (0.4)	0 (0)
SD	3.1 (3.7)	2.9 (3.1)	0.13 (0.15)	0.12 (0.15)	0.04 (0.05)
97.5th percentile	20 (20)	20 (20)	0.6 (0.7)	0.6 (0.7)	0.1 (0.2)
99.5th percentile	24 (26)	24 (26)	0.6 (0.9)	0.6 (0.8)	0.2 (0.3)

*Modulus of VCDR left – VCDR right.

consensus that the optic disc appeared to be clearly pathological. Therefore, prevalences are reported both for cases of definite glaucoma, and cases of definite or probable glaucoma.

Data analysis

We used simple random sampling at block and village level. Therefore, point prevalence estimates are unbiased. Confidence intervals were calculated with Stata (version 8.2; Stata Corporation, TX, USA) "svy" commands to take into account the clustering of individuals in villages.

RESULTS

Study population

Out of a total population of 13 215 enumerated in the nine villages, 1594 people aged 50 years or more were identified and were eligible to undergo clinical examination for glaucoma. Of these, 1324 people (83.1%) responded to the invitation to attend for examination at clinics established in the villages between September 1998 and December 1999; distributions of their age and sex are given in table 1. One or both eyes of 1269 people could be adequately examined for glaucoma. Of 55 people in whom neither eye could be adequately examined, 25 had dense cataract in both eyes, 24 refused examination, and six had one eye that was phthisical or had a corneal scar and had dense cataract in the other eye. One eye could not be adequately examined in a further 40

subjects. All of these had non-glaucomatous fellow eyes and no signs of glaucoma in the eye that could not be examined adequately. They were classified as not having glaucoma and were included in the denominator for calculation of prevalence.

It was possible to classify all but two of the people who attended for examination as blind or not in either eye. The number blind, and prevalences of blindness, in one or both eyes (males and females combined) were 50–59 years, 14/636, 2.2% (95% confidence interval 1.2 to 3.2); 60–69 years, 21/428, 4.9% (2.3 to 7.5); 70–79 years, 26/204, 12.7% (9.1 to 16.4); 80+ years, 13/54, 24.1% (15.6 to 32.5). The prevalences of blindness in both eyes (males and females combined) were: 50–59 years, 1/636, 0.2% (0.0 to 0.4); 60–69 years, 4/428, 0.9% (0.0 to 2.0); 70–79 years, 7/204, 3.4% (1.5 to 5.3); 80+ years, 1/54, 1.9% (0.0 to 5.2).

The distributions of VCDR and intraocular pressure for those who were confirmed not to have glaucoma (that is, excluding glaucoma cases and suspects, and people who could not be adequately examined), and for all people who attended for examination, are shown in table 2. It was not possible to examine or photograph the optic discs, or to measure the intraocular pressure in a small number of patients (3–6%), either because of media opacities or because of refusal to be examined.

Table 3 summarises the numbers and prevalences of definite, and definite and probable, glaucoma cases detected.

Table 3 Number and prevalences of definite (and definite and probable) glaucoma by sex and glaucoma type in people who could be examined adequately (n = 1269)

Age group (years)	Males					Females					Total prevalence
	Diagnostic category			Number	Prevalence, 95% CI	Diagnostic category			Prevalence		
	POAG	PACG	Secondary glaucoma			POAG	PACG	Secondary glaucoma			
50–59	10 (10)	1 (1)	0 (0)	314	3.5, 1.3 to 5.7 (3.5, 1.3 to 5.7)	6 (7)	0 (0)	0 (0)	314	1.9, 0.3 to 3.5 (2.2, 0.1 to 4.3)	2.7, 1.7 to 3.7 (2.9, 1.8 to 3.9)
60–69	7 (10)	0 (0)	1 (1)	192	4.2, 1.6 to 6.7 (5.7, 2.8 to 8.7)	4 (4)	0 (0)	0 (0)	217	1.8, 0.0 to 4.7 (1.8, 0.0 to 4.7)	2.9, 1.5 to 4.3 (3.7, 1.7 to 5.6)
70–79	5 (6)	1 (1)	0 (0)	84	7.1, 1.5 to 12.8 (8.3, 2.4 to 14.2)	4 (7)	0 (0)	0 (0)	102	3.9, 0.8 to 7.0 (6.9, 2.5 to 11.2)	5.4, 2.8 to 8.0 (7.5, 4.1 to 10.9)
80+	0 (0)	1 (1)	0 (0)	21	4.8, 0.0 to 14.4 (4.8, 0.0 to 14.4)	2 (2)	0 (0)	0 (0)	25	8.0, 0.0 to 18.8 (8.0, 0.0 to 18.8)	6.5, 0.0 to 14.1 (6.5, 0.0 to 14.1)
Total	22 (26)	3 (3)	1 (1)	611		16 (20)	0 (0)	0 (0)	658		3.4*

POAG, primary open angle glaucoma; PACG, primary angle closure glaucoma; CI confidence interval.

*Overall prevalence for people aged 50 years or more, age standardised against the total Indian population as described in the 2001 census (see also table 5) (www.censusindia.net/agedata/index.html).

Table 4 Cases of definite (and definite and probable) glaucoma by sex and glaucoma type in people who could be examined adequately (n = 1269)

Characteristic	Definite (and definite and probable) glaucoma cases				Suspect and probable (and suspect) glaucoma cases			
	POAG	PACG	Secondary glaucoma	Total	POAG	PACG	Secondary glaucoma	Total
Sex (M:F)	22:16 (26:20)	3:0 (3:0)	1:0 (1:0)	26:16 (30:20)	24:28 (20:24)	1:1 (1:1)	1:2 (1:2)	26:31 (22:27)
Mean age	61.7 (62.5)	68.3 (68.3)	65.0 (65.0)	62.3 (62.9)	60.3 (57.5)	57.5 (57.5)	58.3 (58.3)	60.1 (59.1)
Age range	50 to 85 (50 to 85)	55 to 80 (55 to 80)	–	50 to 85 (50 to 85)	50 to 75 (50 to 75)	50 to 65 (50 to 65)	50 to 65 (50 to 65)	50 to 75 (50 to 75)

There were 42 definite cases of glaucoma and a further eight probable cases. All but one of the definite cases met the criteria for “level 1 evidence”¹¹; the remaining case was diagnosed as having secondary glaucoma on the basis of clinical signs, no perception of light and extreme cupping in one eye, and intraocular pressure of 62 in the blind eye and 15 in the fellow eye (level 3 evidence¹¹). Five of the probable cases met the VCDR or asymmetry criteria for level 1 evidence of glaucoma (see Methods) but had only suspicious visual field results based on the Henson algorithm, consistent with glaucomatous optic nerve damage (for example, classic, arcuate pattern but few points missed), rather than definite field defects. The remaining three probable cases satisfied the VCDR or VCDR asymmetry criteria for level 2 evidence of glaucoma (see Methods) but had visual field results classified as normal by the Henson algorithm; suspicion about the reliability of the visual field result—for example, evidence of poor fixation, combined with the extreme VCDR findings, led to these cases being described as probable. Except in people aged 80 years or more, the prevalence of definite glaucoma was higher in males than in females. The prevalence of definite glaucoma among males and females combined increased from 2.7% (95% CI 1.7 to 3.7) in people aged 50–59 years to 6.5% (95% CI 0.0 to 14.1) in those aged 80 years or more. These patterns, of increasing prevalence with age and higher prevalence in males, were unchanged if probable glaucoma cases were included.

Table 4 describes the age and sex characteristics of people with different types of glaucoma and glaucoma suspects. Nine of every 10 glaucoma cases were classified as POAG. More definite cases were male than female for each glaucoma type. PACG and secondary glaucoma cases tended to be slightly older than POAG cases, but this finding is based on very few PACG and secondary cases. Based on the WHO definition for blindness (worse than Snellen 3/60¹³), two POAG and one secondary glaucoma cases (all definite) were blind in one eye only; no one with glaucoma was found to be blind in both eyes. No eye was found to be blind from PACG. As was found for definite glaucoma cases, approximately nine of every 10 glaucoma suspects were classified as POAG suspects. There were slightly more female than male suspects. PACG and secondary glaucoma suspects had similar ages compared POAG suspects, but again this finding is based on very few PACG and secondary cases. Based on the WHO definition, none of the suspects were blind in either eye.

DISCUSSION

Of the 1594 people aged 50 years or over in this sample, 83% responded to the invitation to attend for examination for glaucoma. This is a reasonable response for a survey of this kind, similar to the study in urban Hyderabad (85%),^{5,6} less than the response in Tamil Nadu (93%),⁷ but higher than was

achieved in the rural and urban areas of Dhaka (66%).⁸ It should also be pointed out that response rates depend on the accuracy of determination of the population being surveyed—that is, there is likely to be some uncertainty about the true population denominators.

Of those who were not adequately examined for glaucoma, more than half had dense cataracts, or cataract in one eye and the second eye phthisical. It is possible that some of these subjects also had glaucoma so that the overall estimate for the prevalence of glaucoma (3.4%) in this age group may be conservative.

Those who did not attend for examination made up a larger proportion than those who could not be examined adequately. Non-attendance may have introduced bias, either because non-attendees had a higher prevalence of blindness than those who responded (on the grounds of poorer mobility) or because they had a lower prevalence of blindness than those who responded (on the grounds of being more socioeconomically active and unwilling to give up the time to attend). The age and sex distributions for the sample and the whole population were very similar, except for females aged 80 years or over who were under-represented in the sample (see table 1), suggesting that any such bias was small.

The district used for the survey was not chosen randomly but for logistical reasons. This may have introduced bias but we are not aware of any reason why the prevalence of glaucoma or blindness should be different in the chosen district compared to neighbouring ones.

The prevalence of glaucoma in surveys such as the one described here depends on the exact criteria for diagnosis used in each study. For example, using a VCDR of 0.7 as the criterion for diagnosing glaucoma resulted in slightly lower estimates of glaucoma prevalence than if we had used the observed 97.5th percentile for the study sample—that is, 0.6. Therefore, direct comparisons between population based surveys in India can give only approximations of the prevalences and proportions of POAG and PACG. Table 5 compares data from recently published papers that have used the ISGEO criteria, or broadly similar criteria, for diagnosis. The age standardised prevalence of primary glaucoma among people aged 50 years or more in this sample from West Bengal was less than in Hyderabad,^{5,6} but similar to rural Tamil Nadu⁷ and Dhaka (expected to be an ethnically similar population).⁸

What is striking about this present survey is the very small number of cases of PACG that were identified; only three people with PACG out of 1324 were found, a crude prevalence of 0.23% in people aged 50 years or over and a crude ratio of POAG to PACG of more than 10:1. The prevalence of PACG was also relatively low in Dhaka, 0.5% in those aged 40 and over, with the ratio of POAG to PACG of about 4:1. In Tamil Nadu, the ratio of POAG to PACG was 3.4:1, and in Hyderabad 2.4:1 in the same age range (1.95:1 among people

Table 5 Comparison of prevalences of total glaucoma and types of glaucoma from population based surveys in India

Author and year of publication	Location	Setting	% of population examined	Age range of study population (number \geq 50 years)	Prevalence of POAG %	Prevalence of PACG	Prevalence of all glaucoma	Age standardised prevalence \geq 50 years *
Dandona <i>et al</i> , 2000 ^{5, 6, †}	Hyderabad, Andhra Pradesh	Urban	85.4% (2522/2954)	All ages (539)	40–49 years: 1.3 50–59 years: 2.3 60–69 years: 4.9 \geq 70 years: 6.3	40–49 years: 0.0 50–59 years: 1.5 60–69 years: 2.2 \geq 70 years: 3.2	40–49 years: 1.3 50–59 years: 3.8 60–69 years: 7.1 \geq 70 years: 9.5	6.1%
Ramakrishnan <i>et al</i> , 2003 [‡]	Madurai, Tamil Nadu	Rural	93.0% (5150/5539)	\geq 40 years (3084)	40–49 years: 0.3 50–59 years: 1.6 60–69 years: 1.8 \geq 70 years: 2.9	40–49 years: 0.5 50–59 years: 0.5 60–69 years: 0.5 \geq 70 years: 0.5	40–49 years: 1.6 50–59 years: 2.8 60–69 years: 3.1 \geq 70 years: 4.1	3.2%
Rahman <i>et al</i> , 2004 [§]	Dhaka, Bangladesh	Rural and urban	65.9% (2347/3562)	\geq 35 years (1102)	40–49 years: 1.1 50–59 years: 1.9 60–69 years: 2.0 70–79 years: 1.9 \geq 80 years: 1.1	40–49 years: 0.4 50–59 years: 0.6 60–69 years: 0.6 70–79 years: 0.6 \geq 80 years: 0.4	40–49 years: 1.5 50–59 years: 2.5 60–69 years: 2.6 70–79 years: 2.5 \geq 80 years: 1.5	2.4%
Raychaudhuri <i>et al</i>	Calcutta, West Bengal	Rural	83.1% (1324/1594)	\geq 50 years (1269)	50–59 years: 2.5 60–69 years: 2.7 70–79 years: 4.8 \geq 80 years: 4.3	50–59 years: 0.2 60–69 years: 0.0 70–79 years: 0.5 \geq 80 years: 2.2	50–59 years: 2.7 60–69 years: 2.9 70–79 years: 5.4 \geq 80 years: 6.5	3.4%

*Age standardised prevalences among people aged \geq 50 years were estimated on the basis of the total Indian population as described in the 2001 census (www.censusindia.net/age-data/index.html).

†Dandona and colleagues^{5, 6} only reported cases of POAG and PACG; the estimated age specific prevalences of all glaucoma, and the overall age standardised prevalence of glaucoma among people aged \geq 50 years, are therefore based only on cases of POAG and PACG.

‡Ramakrishnan and colleagues⁷ only reported overall prevalences of PACG and other glaucomas; the estimated age specific prevalences of PACG and all glaucoma, and the overall age standardised prevalence of glaucoma among people aged \geq 50 years, assume PACG and other glaucomas had similar prevalences across age groups.

§Rahman and colleagues⁸ only reported the overall numbers of POAG and PACG; the estimated age specific prevalences of POAG, PACG and all glaucoma, and the overall age standardised prevalence of glaucoma among people aged \geq 50 years, assume the ratio of POAG and PACG was constant across age groups and there were no cases diagnosed with glaucoma other than POAG and PACG.

aged 50 years or more in Hyderabad). These proportions suggest that PACG may be less prevalent in Bengalis than in Indian populations living further south in the subcontinent. Calculation of prevalence estimates and confidence intervals needs to be tailored to the sampling methods used to prevent bias and to avoid underestimating the precision of estimates. These issues are particularly important if sampling has been stratified by a factor likely to be associated with the health state of interest or, when multistage sampling has been used, the prevalence of the health state of interest varies markedly between clusters. The surveys described in table 5 used various sampling methods and appear to have reported appropriate analyses.

There was one case of secondary glaucoma and two suspects. The definite case was caused by a hypermature cataract. The two suspects had pseudoexfoliation.

The Vellore Eye Study⁴ (excluded from table 5) concluded that PACG was about five times as common as POAG in that part of Tamil Nadu. However, in that study people were classified as PACG cases on the basis of peripheral anterior synechiae and raised intraocular pressure in the presence of closed angles on gonioscopy, without necessarily having evidence of optic nerve damage. Only nine subjects were found to have glaucomatous field defects, four of whom were classified as POAG and five as PACG giving a ratio of about 1:1.

It is also notable from the present study that none of the 1269 people who could be adequately examined had a blind eye as a result of PACG. Indeed, no one was found to be bilaterally blind because of glaucoma, although two people were blind unilaterally as a result of POAG and one as a result of secondary glaucoma. PACG, therefore, does not seem to be a major public health problem among rural Bengalis.

An unexpected observation in the Dhaka survey was that the prevalence of glaucoma was relatively high in younger people (age 35–49 years) and did not increase with age. Although the present study only included people aged 50 years and over, glaucoma prevalence increased with increasing age, which does not support the finding in the Dhaka survey.

From the point of view of eye care programmes and prevention of blindness, the available survey data imply that the emphasis in both West Bengal and Dhaka should be on the detection of POAG. There is still no satisfactory method of screening for POAG which can be applied to populations, especially in low income countries. As Thomas and colleagues concluded in their letter on glaucoma in southern India,¹⁴ "On balance, we believe there is no current alternative to case detection (opportunistic screening), developing our infrastructure, and making routine gonioscopy the norm."

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Authors' affiliations

A Raychaudhuri, Department of Ophthalmology, Institute of Post Graduate Medical Education and Research, Kolkata, India

S K Lahiri, Department of Community Medicine, Medical College, Kolkata, India

M Bandyopadhyay, Regional Institute of Ophthalmology, Kolkata, India

P J Foster, Department of Epidemiology, Institute of Ophthalmology, London, UK

B C Reeves, Department of Public Health and Policy, London School of Hygiene and Tropical Medicine, London WC1E 7HT, UK

G J Johnson, International Centre for Eye Health, London School of Hygiene and Tropical Medicine, London, UK

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