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Original Article

Prevalence of glaucoma in Sunsari district of eastern Nepal

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Abstract

Aims: To determine prevalence of glaucoma and glaucoma suspect in subjects 40 years and above in Sunsari district of eastern Nepal.

Methods: A community based cross sectional study examining 1600 selected subjects was carried out. In all subjects best corrected visual acuity was determined. Oblique torch light test was used for anterior chamber depth evaluation. Intraocular pressure (IOP) measurements with Perkins tonometer and fundus examination were carried out in the community. Subjects diagnosed as glaucoma suspect were further evaluated in the hospital using slit lamp examination, gonioscopy and Goldmann perimetry.

Glaucoma was defined by characteristic disc and visual field changes irrespective of the level of IOP.

Results: Of 1600 subjects examined, the prevalence of glaucoma was found to be 0.938%. The prevalences of primary open angle glaucoma, primary angle closure glaucoma, secondary glaucoma and ocular hypertension were 0.562%, 0.125%, 0.250% and 0.500% respectively. Lens induced glaucoma accounted for all the cases of secondary glaucoma.

Conclusion: The prevalence of glaucoma in the Sunsari District of Nepal is 0.938%, which is lower than that reported in the neighboring regions. Lens induced glaucoma is highly prevalent as a cause of secondary glaucoma.

Key words: Glaucoma, prevalence, Eastern Nepal, secondary glaucoma

Glaucoma is second leading cause of irreversible blindness in the developing countries [1-3]. To decrease the morbidity due to glaucoma it is important to know the distribution and severity of the problem. There is a limited data on prevalence of glaucoma in Nepal. The present community based study was carried out with an objective to determine the prevalence of the glaucomas and glaucoma suspect among the people of 40 years and above in Sunsari district of Eastern Nepal.

Materials and methods

Population and sampling

Eastern Region of Nepal is divided into 16 districts. BP Koirala Institute of Health Sciences is situated in Sunsari District. This district is divided into 49 Village Development Committees (V.D.C.). The total number of households at the time of the study was 12, 8155 with a population of 640259 (males =321962 and females =318297). There were 122,579 subjects who were 40 years and above at the time of the study. The calculated sample size was 1581, taking glaucoma prevalence of 1% and standard error of 0.25%. To remove the bias due to non response, the sample size finally selected was 2000 considering 80% - 85% participation rates. One VDC (Babiya) was randomly selected using lottery system for this study. The total population of Babiya at the time of study was 6823 with 3478 males and 3345 females. The number of total households is 1092 (Source: Nepal district profile: An introduction to Sunsari district 1999: Babiya V.D.C pp 69).

One of the authors (RPS) organized a one-day interactive program at the Babiya VDC office in the presence of the VDC Chief, the Sub Health Post In-charge of the VDC, local social volunteers, health workers and representatives of different ethnicity. They were informed regarding the nature of survey and an informed consent was obtained. Their help was sought to contact the subjects residing in the region. The data containing the details of population in the VDC was obtained from the population registry and the final population of 2000 individuals of age 40 years and above was selected with the help of existing census register from the VDC using systematic randomization method.

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The subjects away from the region during the examination period were excluded. Enumeration of households and subjects was performed by one of the authors (RPS). Households were divided into 5 groups and all eligible subjects residing there were examined on a designated day (at a local health center). Those subjects failing to attend the examination when called twice were excluded from the study.

Informed consent was obtained from the heads of the households and assigned health worker or social volunteers working in the region. Subjects coming for examination were verbally informed of the nature of survey and ocular examinations to be carried out. At the first meeting all the subjects consented for the examination. This study was approved by the Ethical Review Committee of the BP Koirala Institute of Health Sciences. The study period was from August 2003 to July 2004.

Examination procedure

Proved and structured questionnaire was used for the interview of study participants. The questionnaire was in English but the interviewer (RPS) with knowledge of English and the local language translated and explained the questionnaire to the participants at the time of interview in their vernacular. A pilot survey was conducted before commencement of the study to standardize the procedures, questionnaire and examination methods.

Detailed history on ethnicity, educational statutes, profession and income was obtained from the head of the household. Subjects were also asked regarding the history of hypertension, diabetes and cardiovascular events.

Visual acuity measurement and refraction were done by ophthalmic assistants. Ocular examination was carried out by the trained ophthalmologists.

Ocular examination

Sixteen subjects (having leucomatous corneal opacities, phthisis bulbi and impairing anterior and posterior segments evaluation) were excluded from the study. In the rest following examinations was carried out. Visual acuity was determined by non-illuminated illiterate 'E' chart in day light followed by dry refraction to determine the best corrected visual acuity.

A torch light and a magnifying loupe were used to evaluate the anterior segment of the eye including pupillary size, shape, reaction and anterior chamber depth. Subjects having ellipse sign were recorded as having shallow anterior chamber. A hand held Perkins applanation tonometer was used with standard techniques to record the intra-ocular pressure (IOP) and direct ophthalmoscope (Heine Beta-200 Germany) was used to evaluate the fundus. Pupil was dilated with a drop of 1% Tropicamide in all cases with no contraindication and the vertical cup to disc ratio, the status of neuroretinal rim and other positive findings were recorded. Subjects diagnosed as glaucoma suspect were brought for a second examination in the Out Patient Department (OPD) of the BPKIHS.

Ocular examination included determination of best corrected visual acuity (BCVA), slit lamp examination and determination of anterior chamber depth (using van Herick method), applanation tonometry (average of three measurements with Goldmann tonometer with topical anesthesia using 4% xylocaine), gonioscopy (Goldmann single mirror) and evaluation of optic disc under stereoscopic vision with pupil dilated (90D lens) and visual field analysis (using Goldmann perimeter)..

In cases where the diagnosis could still not be confirmed the subjects were declared not to have glaucoma at the time of examination for the purpose of this study but were suggested to be followed up in the glaucoma clinic of the Department periodically.

In subjects with an occludable angle but without features of angle closure glaucoma (i.e. a normal IOP, a normal disc and field, with no iris or lens ischemic changes, or peripheral anterior synechiae), a dark room prone provocative test was performed. A rise in the IOP of $\geq$ 8 mm Hg was considered to be a positive result.

Diurnal variation was performed in all subjects where only one variable, visual field or optic disc was found to be abnormal. During the study period whenever any treatable ocular morbidity was found, it was either treated locally or referred to higher center for further evaluation and management.

For the purpose of this study the following diagnostic criteria were adopted.

1. Glaucoma was diagnosed in participants with characteristic disc and visual field changes irrespective of the level of IOP.
2. Age of the participants was recorded in completed years at the time of interview.
3. Diminution of visual acuity (DVA): Any dimness of distant vision was recorded as 'yes'.
4. History of headache, eye ache, redness, colored haloes, associated with nausea and vomiting and family history of glaucoma were recorded. Self reported history of physician diagnosed

hypertension and diabetes mellitus was asked and recorded.

5. Ocular Hypertension: IOP≥21 mmHg without visual field or optic disc abnormalities in the absence of an occludable chamber angle and no signs of secondary glaucoma.
6. Primary Open Angle Glaucoma: IOP≥21 mmHg associated with either glaucomatous optic disc abnormalities or glaucomatous visual field abnormalities or with both. The chamber angle had to be non-occludable and devoid of goniosynechia.
7. Normal Tension Glaucoma: IOP ≤21 mm Hg associated with both glaucomatous optic disc abnormalities and glaucomatous visual field abnormalities.
8. Primary Angle Closure Glaucoma: IOP ≥21 mmHg associated with either glaucomatous optic disc abnormalities or glaucomatous visual field abnormalities or with both, associated with one or more of the following criteria.
    a. Chamber angle partially or totally closed, presence of goniosynechia or a very narrow angle clearly prone to occlusion.
    b. Objective evidence (e.g. atrophy of iris, irregular pupil, non-reactive mydriasis).
    c. Absence of signs of secondary angle closure (e.g. intumescent or dislocated lens, microspherophakia).
9. Secondary glaucoma: IOP ≥21 mmHg associated with either glaucomatous optic disc abnormalities or glaucomatous visual field abnormalities or with both, associated with evidence of glaucomatogenic mechanisms secondary to other eye disorders, medical or surgical treatment or trauma.
10. Glaucoma suspect: subjects with raised IOP or glaucomatous optic disc changes or glaucomatous visual field abnormalities in isolation.

Statistical analysis:

SPSS 11.0 soft ware was used for data analysis. Prevalence rates of glaucoma were calculated and 95% CI was found using the formula p ± random sampling error.

Results

A total of 1600 people (84% of the eligible candidates) were examined. Four hundred subjects couldn't be examined (16 with ocular morbidity preventing examination, 386 did not turn up in the day of examination or left the region after enumeration)

The number of female (811, 50.7%) participants was higher than that of the male counterparts (789, 49.3%). The mean age of males was 50 years (SD ± 4.5; range: 40 - 85 yrs) and for the females it was 51 (SD ± 4.7; range: 40 - 89 yrs). The intraocular pressure among the participants varied from 8 – 38 mmHg with majority (98%) between 11 – 20 mmHg. In 1.4% of participants the IOP was more than 20 mm Hg and in another 0.4% below 10 mmHg. Distribution of IOP among participants is shown in Table 1.

The vertical cup – disc ratio (C: D) was in the range of 0.2:1 – 0.9:1. In 81.45% of the participants the C: D was 0.3:1. In two blind participants there was bilateral optic atrophy of non-glaucomatous type. In another 107 participants (6.68%) the C: D was more than 0.4:1, out of which 0.5:1 was in 24 (1.5%), 0.7:1 in 2 (0.12%) and 0.8:1 in 4 (0.25%) participants. Details are given in Table 2.

A total of 130 (8.16%) participants were suspected to have glaucoma. Of these glaucoma was confirmed in 15 (0.94%) participants. Of these, POAG was found in 9 (0.55%), PACG in 2 (0.12%) and Secondary Glaucoma in 4 (0.25%). All the Secondary Glaucomas were of lens induced type. Ocular hypertension was diagnosed in 8 (0.55%) participants. There were no cases with normal tension glaucoma or pseudoexfoliation. Three of the participants were blind in both eyes where as four persons were blind in either eye. Prevalence of glaucoma and causes of blindness are shown in Tables 3-5.

Table 1: Intra-ocular Pressure (IOP) Among the Participants

Intraocular Pressure (mmHg)	Number	Percentage
≤10	6	0.42
11-15	776	48.46
16-20	795	49.68
21-25	10	0.62
26-30	5	0.31
31-40	8	0.5
Total	1600	100

Table 2: Vertical Cup to Disc Ratio/Atrophy of the Optic Nerve Head among the Participants

Cup/Disc Ratio	Number	Percentage
0.2:1	188	11.75
0.3:1	1303	81.45
0.4:1	77	4.81
0.5:1	24	1.5
0.6:1	0	0
0.7:1	2	0.12
0.8:1	4	0.25
0.9:1	0	0
Optic Atrophy (nonglaucomatous)	2	0.12
Total	1600	100

Table 3: Prevalence of glaucoma

Diagnosis	Number	Prevalence	95% CI
Glaucoma Suspect	45	2.813	2.805-2.821
POAG	9	0.562	0.561-0.562
PACG	2	0.125	0.124-0.125
Secondary glaucoma	4	0.250	0.249-0.250
Ocular Hypertension	8	0.500	0.499-0.500
Total glaucoma patients	15	0.938	0.937-0.938

Table 4: Distribution of glaucoma with age and gender

Age (years)	Glaucoma Suspect	POAG	PACG	Secondary Glaucoma	Ocular hypertension	Total
40-49	8	3	0	0	3	14
50-59	13	5	0	1	2	21
60-69	17	1	1	1	1	21
70-79	7	0	1	1	2	11
80-89	0	0	0	1	0	1
Total	45	9	2	4	8	68
Male	25	5	1	1	5	37
Female	20	4	1	3	3	31

Table 5: Causes of Blindness due to the Glaucoma

Diagnosis/ Age Group	40-49	50-59	60-69	70-79	80-89	Total
POAG	0	1	1	0	0	2
PACG	0	0	1	0	0	1
Secondary Glaucoma	0	1	1	1	1	4
Males	0	1	1	1	0	3
Females	0	1	2	0	1	4
Total	0	2	3	1	1	7

Discussion

The prevalence of adult glaucoma differs with the geographical distribution of population. In Africa, where open angle glaucoma is more prevalent, there is a similar pattern of glaucoma as observed in subjects of European decent or blacks residing in Europe. Angle closure glaucoma is reported more frequently amongst Asians of mongoloid origin and oriental races[4-10]. There is no well documented community based study on prevalence of glaucoma reported in Nepali population. Pattern of glaucoma in neighboring countries like India shows almost equal proportion of open and angle closure glaucoma. We found prevalence of glaucoma in subjects ≥ 40 years to be 0.938 %, which is lower than most of the study reported from the Asian countries. We didn't find any case of normal tension glaucoma or exfoliation glaucoma. Prevalence of other types of glaucoma was also lower than reported in Asian population. Similar lower prevalence are reported from Sierra Leone (0.6%) [11] and Malawi (0.8%)[12]

These differences can be explained in terms of different examination methods used or ethnic differences in these populations[13]. Because in the field we have used Perkins applanation tonometer, which is not a gold standard for IOP measurement as it tends to underestimate the IOP, it is likely that borderline high IOP may have been missed.

To grade the anterior chamber depth, 3 methods have been described to be used in field: oblique flash light method, limbal anterior chamber depth and axial anterior chamber depth. We used oblique flash light test to grade the anterior chamber depth. Though high sensitivity and specificity have been claimed in studies from China, it is likely that this method may underestimate the actual number of angle closure suspect[14]. We used Goldmann perimetry, which is a good instrument in trained hand, but is inferior to modern high sensitivity perimetry and is likely to miss subtle or early visual field defects. With all these limitation enumerated, we feel that some subjects with early glaucomatous changes might have been missed during the survey. A larger sample size, with examination techniques taking care of above limitations can be recommended for future studies. The other important finding we would like to highlight is the high number of subjects with characteristic disc changes and normal intraocular pressure. These subjects were not found to have visual field defects in perimetry or abnormal IOP in diurnal variation. Most of these subjects were labeled as glaucoma suspects. High prevalence of normal tension glaucoma has been reported in studies from Japan[15]. We found almost equal number of subjects having POAG and Ocular hypertension (OHT). Similar findings have been reported in the studies reported from Japan[15] and Europe[16,17]; Higher prevalence of OHT is reported in a study conducted in St Lucia, West Indes[17].

We found a lower prevalence of angle closure glaucoma in our population as compared to the studies in mongoloid population. There was a higher prevalence of secondary glaucoma all being of lens induced type, which suggests that there is a poor coverage for cataract surgery in this region. While studying the visual acuity in the patients diagnosed to have glaucoma, we found 20% of the patients bilaterally blind due to glaucoma. Similar higher prevalence than that reported in studies from India[18], suggest that patients with glaucoma in this region present late or not at all to the hospitals. It is likely that early detection of these cases would help prevent or retard the visual loss in these patients.

Conclusion

The prevalence of glaucoma in Sunsari District of Nepal is 0.938%, which is lower than that reported in the neighboring regions. Lens induced glaucoma is highly prevalent as a cause of secondary glaucoma, which reflects on the inadequate coverage of cataract surgery in the region. The findings of this study could be of help in the search of a sensitive screening test for glaucoma in a rural community.

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