Evaluation of Screening Tests and Prevalence of Glaucoma : Integrated Health Research Program for the Thai Elderly

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Abstract

The purposes of this study were to evaluate the accuracy of glaucoma screening tests and to assess the prevalence of glaucoma in an elderly Thai population over 60 years of age. This was a cross-sectional study. 3706 subjects were recruited from 33 communities in the vicinity of Siriraj Hospital. All received an eye examination from ophthalmologists and general practitioners including visual acuity, Schiotz tonometry and optic disc evaluation in their residential communities. Subjects who were suspected of having glaucoma were re-examined at the Glaucoma Clinic, Siriraj Hospital. They were then classified as having definite glaucoma of a specific type or as not having glaucoma. The overall prevalence of glaucoma was 6.1 per cent (128/2092). The percentages of primary open angle glaucoma, primary angle closure glaucoma, normotension glaucoma and secondary glaucoma were 47.7 per cent, 41.4 per cent, 9.4 per cent, and 1.6 per cent respectively. The sensitivity and specificity of the screening tests performed by ophthalmologists were 100 per cent and 97.2 per cent and those performed by general practitioners were 21.7 per cent and 96.5 per cent.

Key word : Glaucoma, Screening Tests, Prevalence

In Thailand, the elderly population has increased rapidly. The quality of life of these elderly is the concern of policy planners and eye disease is one of the major health problems in the elderly. Glaucoma is one of the most frequent causes of visual loss all over the world. According to Quigley [1], Ezepue[2], and Chiemchaisri[3], it is the second leading cause of blindness. The prevalence of glau-

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coma in many countries is different due to the geographical location and ethnic composition of the population studied[1,4-14]. Glaucoma causes irreversible blindness and fewer than 50 per cent of those with glaucoma are aware of their disease[1]. This may be due to the asymptomatic nature of chronic types of glaucoma. The screening test in communities will help in the early detection of their disease. Epidemiological studies specifically targeted at glaucoma have not previously been conducted in Thailand.

The purposes of this study were to evaluate the accuracy of screening tests for glaucoma and to assess the prevalence of glaucoma in an elderly Thai population.

MATERIAL AND METHOD

This was a cross-sectional study conducted in 33 communities in the vicinity of Siriraj Hospital from October 1997 to September 1998. The sample size was calculated by assuming a 2 per cent prevalence of the disease and a margin of error of 0.6 per cent. The study population should contain at least 2000. The resident population aged 60 years and over, registered by the survey team of this project in Bangkok Noi and Bangkok Yai districts was invited to participate in the study.

Procedures

All invited participants received a screening examination by 14 staff members of the Department of Ophthalmology and 6 first-year ENT residents as general practitioners according to a standard protocol in the communities. The screening protocol composed of a medical history questionnaire and an ophthalmologic examination, including visual acuity, Schiotz tonometry and optic disc evaluation by direct ophthalmoscope. Then, they were classified as not having glaucoma or as definite or suspected glaucoma. The definite and suspected groups were re-examined by 3 glaucoma specialists (A.M., N.R., R.T.) at the Glaucoma Clinic, Siriraj Hospital. A diagnostic examination included the following tests : intraocular pressure measurement by Goldmann's applanation tonometry, an anterior chamber angle evaluation by gonioscopy, stereoscopic optic disc evaluation by a 90-diopter lens with slit lamp under dilated pupil, visual field testing by Humphrey field analyzer using program 30-2 and a diurnal tension test for suspected cases of normotension glau-

coma. They were then classified as having definite glaucoma of a specific type or as not having glaucoma.

Working definitions

The criteria to submit the participants to a diagnostic test were the presence of at least one of the following criteria at the screening examination: (1) intraocular pressure >20 mmHg. ; (2) glaucomatous abnormality of the optic disc (a cup/disc ratio >0.3).

The criteria for definite glaucoma were at least two of the following three criteria observed: (1) intraocular pressure ≥21 mmHg. ; (2) glaucomatous optic disc abnormality and (3) glaucomatous visual field defects[8,9,15].

The following were considered abnormalities of the optic disc: a cup/disc ratio ≥0.4 and asymmetrical disc excavation with a difference in cup/disc ratio >0.2 between the two eyes. The diagnosis of a glaucomatous visual field defect was formulated on the basis of the single field analysis characteristic and the use of the Humphrey statpac II program.

Classification of the various forms of glaucoma

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

Primary open angle glaucoma (POAG)

At least two of the criteria for glaucoma observed and gonioscopic examination revealed an open anterior chamber angle.

Primary angle-closure glaucoma (PACG)

At least two of the criteria for glaucoma observed and the anterior chamber angle was partially or totally closed. In case of an acute attack, the diagnosis depended on the clinical picture of acute angle closure glaucoma (ciliary injection, cornea edema, mid-dilated pupil, narrow anterior chamber and increased intraocular pressure). However, no single case of acute glaucoma was verified in this study.

Normotension glaucoma (NTG)

The criteria were a glaucomatous optic disc and glaucomatous visual field defect with an intraocular pressure below 20 mmHg and the anterior chamber angle not prone to occlusion.

Secondary glaucoma

At least two of the criteria for glaucoma observed and objective or medical history identification of glaucomatogenic mechanisms secondary to other eye diseases, eye surgery, eye trauma or other systemic diseases.

Statistical analysis

The prevalence of glaucoma and the 95 per cent confidence interval were calculated. The percentages of specific types of glaucoma were described. Sensitivity and specificity of the screening tests performed by ophthalmologists and general practitioners were calculated separately.

RESULTS

A total of 3,706 subjects were invited to a screening examination, 2,114 subjects were examined with an overall participation rate of 57 per cent. Complete data for 2,092 subjects were obtained. There were 676 men (32.3%) and 1,416 women (67.7%) with an average age of 67.9±6.5 years (60 years - 104 years). From the screening examination, 1,841 cases were classified as not having glaucoma and 251 cases were classified as definite and suspected glaucoma. All 251 cases of suspected glaucoma and 200 cases of non-glaucoma were submitted to a diagnosis examination. 239 cases of suspected glaucoma and 134 cases of non-glaucoma were re-examined at the glaucoma clinic, 128 cases were diagnosed as definite glaucoma. Therefore, the overall prevalence of glaucoma was 6.1 per cent (128/2092) with a 95 per cent confidence interval of 5.1, 7.2. The percentages and prevalences of the various clinical forms of glaucoma are given in Table 1. The two cases of secondary glaucoma were caused by traumatic lens subluxation.

According to the age distribution, the prevalence of glaucoma increased with increasing age (Table 2). For the sex distribution, glaucoma was found in women more than men (Table 3).

Of the 128 cases of glaucoma, 59 cases were known cases and 69 cases were first diagnosed as having glaucoma in this study. To evaluate the screening tests, the authors calculated the sensitivity and specificity from the first diagnostic cases. The data of the screening tests performed by ophthalmologists and general practitioners are shown in Table 4 and 5. The sensitivity, specificity, positive predictive value and negative predictive value of the screening test are shown in Table 6.

The authors considered the screening criteria used for the diagnosis of glaucoma in 69 cases (Table 7) and found that general practitioners could not identify a glaucomatous optic disc and could not perform intraocular pressure measurement properly.

Table 1.   Percentages and prevalences of different forms of glaucoma.

Type of glaucoma	No. of cases	%	Prevalence	95%CI
Primary open angle	61	47.65	2.9	2.2, 3.6
Primary angle closure	53	41.41	2.5	1.9, 3.2
Normotension	12	9.37	0.6	0.3, 0.9
Secondary	2	1.56	0.1	0.0, 0.9
All	128	100	6.1	5.1, 7.2

Table 2.   Age-corrected proportion of glaucoma cases.

Age (years)	Total population	No. of glaucoma	%
60-69	1,345	75	5.6
70-79	610	47	7.7
≥ 80	137	6	4.4
All	2,092	128	6.1

Table 3.   Ratio of males and females of different forms of glaucoma.

Type of glaucoma	Total	Males	Females	M:F
POAG	61	26	35	1 : 1.3
PACG	53	13	40	1 : 3
NTG	12	6	6	1 : 1
Secondary	2	2	-	
All	128	47	81	2 : 3.5

POAG = Primary open angle glaucoma
PACG = Primary angle closure glaucoma
NTG   = Normotension glaucoma

Table 4.   The results of screening tests performed by ophthalmologists and the results of diagnostic tests at the Glaucoma Clinic.

Ophthalmologist diagnosis	Glaucoma Clinic diagnosis		
	Glaucoma	Non-glaucoma	Total
Glaucoma + Gl. Suspect	69	55	124
Non-glaucoma	0	1,897	1,897
Total	69	1, 952	2,021

Table 5.   The results of screening test performed by general practitioners and the results of diagnostic tests at the Glaucoma Clinic.

G.P diagnosis	Glaucoma Clinic diagnosis		
	Glaucoma	Non-glaucoma	Total
Glaucoma + Gl. Suspect	15	69	84
Non-glaucoma	54	1,883	1,937
Total	69	1,952	2,021

DISCUSSION

Many previous glaucoma surveys in Thailand have been performed as part of the blind registration surveys and glaucoma has been found to be one of the leading causes of blindness[3,16]. For the irreversible blindness group, glaucoma was the first one[3]. These previous studies did not include early cases of glaucoma and were done on a hospital basis. On the contrary this study was based on the population of a defined area and aimed at identifying all cases of glaucoma.

The prevalence of glaucoma in many studies varied from 0.65 per cent to 8.8 per cent[4-13].

These discrepancies can be explained partly in terms of the different procedures used and the different glaucoma definition adopted, while in other cases the differences between the ethnicity and the age of the study population should be considered.

The overall prevalence of glaucoma in the present study was 6.1 per cent and increased to 7.7 per cent in the population aged 70 to 79. This finding resembles that reported in the Egna-Neumarkt study in Italy[9], the American Eskimos Study of Arkell[12] and the Beaver Dam study in the USA[8]. The authors concluded that the prevalence of glaucoma increases with age.

Table 6.   Sensitivity, specificity, positive predictive value and negative predictive value of the screening test performed by ophthalmologists and general practitioners.

	Ophthalmologists		General practitioners	
	%	95%CI	%	95%CI
Sensitivity	100.0	93.4, 100.0	21.7	13.1, 33.6
Specificity	97.2	96.3, 97.8	96.5	95.5, 97.2
Positive predictive value	55.6	46.5, 64.5	17.9	10.7, 21.8
Negative predictive value	100.0	99.7, 100.0	97.2	96.4, 97.9

Table 7.   Details of the 69 cases first detected by screening tests by ophthalmologists and general practitioners.

Screening criteria	Ophthalmologists	General practitioners
High IOP	17	13
High IOP + Glaucomatous disc	17	-
Glaucomatous disc	35	2
All	69	15

IOP = Intraocular pressure

Race and sex appear to be important factors in glaucoma. In this study, the prevalence of POAG is slightly higher than the prevalence of PACG. This finding is the same as studies from Japan[5], Singapore[7] and other Asian countries[4]. It differs from the prevalence of glaucoma in Western countries in that the numbers of POAG are much higher than the numbers of PACG[8-11,13]. In the present study, females were affected by this disease more than males. This is almost identical to the study in Japan[5] and Western countries[8-10].

Most cases of glaucoma have no symptoms until late in the disease. As this disease is easier to treat in the early stage, the authors were concerned about a method for early detection. Screening tests for glaucoma are aimed at identifying those cases. In this study, the sensitivity and specificity of the screening tests performed by ophthalmologists are very high. But the sensitivity of the screening tests performed by general practitioners is low. The authors assumed that the screening tests are useful when performed by experienced personnel.

From the 69 cases detected by screening, general practitioners could not detect glaucomatous cupping because the examination of the fundus in the elderly is difficult due to the presence of cataract and they also lack experience in identifying a glaucomatous optic disc. The screening tests performed by ophthalmologists yielded a high sensitivity and specificity but the positive predictive value was only 55.6 per cent. It meant that only half of the suspected cases were definite glaucoma. This figure may be due to the fact that the screening criteria used in this study were not precise, so it included non-glaucoma cases that only had high intraocular pressure or only a large cup/disc ratio without other figures that fit the criteria for definite glaucoma. In the normal eye, the cup/disc ratio is usually 0.3 but Caspel found that about 2 per cent of normal people had a cup/disc ratio of over 0.7[17]. However, intraocular pressure measurement alone cannot detect all cases of glaucoma. A single intraocular pressure measurement has a limited ability to identify suspected glaucoma because the intraocular pressure has the diurnal pattern[18]. In the Baltimore eye survey, Tielsch[19] found that the use of tonometry alone did not yield a high sensitivity, but when combined the two criteria: glaucomatous cupping and tonometry, the sensitivity of the screening test was increased.

General practitioners usually take care of most elderly patients. With sufficient skill in the use of tonometry and the direct ophthalmoscope they would be able to detect early cases of glaucoma. From this study, the authors suggest that general practitioners should gain more experience in eye examination.

SUMMARY

The prevalence of glaucoma in elderly Thais was 6.1 per cent and it increased with age. This finding was similar to that reported in other countries. The percentage of primary open angle glaucoma is slightly higher than that of primary angle closure glaucoma. Glaucoma was more common in females than in males. Screening tests performed by skilled personnel show a high degree of accuracy in detecting glaucoma. This study emphasizes that the skill of general practitioners in performing eye examination should be improved.

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การศึกษามาตรการการคัดกรองและความชุกของโรคต้อหินในผู้สูงอายุไทย : แผนงานวิจัยเพื่อสุขภาพผู้สูงอายุ (วสส.)

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การศึกษานี้เป็นการศึกษาแบบตัดขวาง โดยศึกษาจากผู้สูงอายุจำนวน 3,706 คน ใน 33 ชุมชนรอบโรงพยาบาลศิริราช ระหว่าง ธันวาคม 2540 ถึง พฤษภาคม 2541 ผู้สูงอายุจะได้รับการตรวจตาจากจักษุแพทย์และแพทย์เวชปฏิบัติ ในชุมชน โดยตรวจวัดสายตา, วัดความดันตา, และตรวจขั้วประสาทตา ผู้ที่สงสัยว่าจะเป็นโรคต้อหินจะได้รับการตรวจตาซ้ำ อีกครั้งที่คลินิกโรคต้อหินโรงพยาบาลศิริราชผลการศึกษาพบว่ามีผู้สูงอายุเป็นโรคต้อหิน 128 คนคิดเป็นความชุกของโรคต้อหินร้อยละ 6.1 (128/2092) และพบว่าเป็นโรคต้อหินชนิดมุมเปิดร้อยละ 47.7 โรคต้อหินชนิดมุมปิดร้อยละ 41.4 โรคต้อหินชนิด Normotension ร้อยละ 9.4 และโรคต้อหินทุติยภูมิร้อยละ 1.6 จากการวิเคราะห์ความไว และความจำเพาะ พบว่าการตรวจตาแบบคัดกรองโดยจักษุแพทย์มีความไวร้อยละ 100 ความจำเพาะร้อยละ 97.2 และการตรวจตาแบบคัดกรอง โดยแพทย์เวชปฏิบัติมีความไวร้อยละ 21.7 และ ความจำเพาะร้อยละ 96.5

คำสำคัญ : โรคต้อหิน, มาตรการการคัดกรอง, ความชุก

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