

CLINICAL SCIENCE

Awareness of glaucoma, and health beliefs of patients suffering primary acute angle closure

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Aim: To evaluate the factors associated with lack of awareness of glaucoma and late presentation to the doctor in Singapore Chinese patients with acute angle closure (AAC)

Methods: A prospective, hospital based case series of 105 patients aged 35 years and above who presented with a first attack of AAC in a tertiary hospital in Singapore was conducted. A research assistant interviewed all patients face to face in clinic and recorded demographic factors, awareness of glaucoma, and subjective barriers to seeing a doctor. The time from onset of symptoms to presentation at the clinic was noted.

Results: Overall, 22.9% of patients had heard of glaucoma. The multivariate adjusted odds ratio (OR) of unawareness of glaucoma in older people (> 60 years) was 1.5 (95% confidence interval (CI) 0.5 to 4.6), 3.2 (95% CI 1.1 to 9.2) for adults who were not working, and 13.8 (95% CI 1.3 to 146.7) for patients who had less than a pre-university education. A significant proportion (31.7%) of patients presented to the doctor 24 hours or more after symptoms occurred. In a multiple logistic regression model, the adjusted OR of late presentation was 8.5 (95% CI 1.04 to 69.5) if there was no car access, 5.0 (95% CI 1.0 to 24.6) if the patients spoke Chinese, and 3.3 (95% CI 0.9 to 11.9) if there was nobody to accompany to hospital.

Conclusion: Glaucoma awareness among patients suffering AAC was not high. Lack of awareness was associated with increasing age, lack of formal education, and unemployment. A significant proportion of patients seek medical attention late. Risk factors for late presentation include lack of car access, nobody to accompany the patient, and speaking the Chinese language primarily. Health education programmes may help increase the knowledge and awareness of glaucoma.

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A growing body of data suggests that glaucoma is a leading cause of blindness in east Asia.^{1–3} A recent population based survey in Singapore found that glaucoma was responsible for 60% of cases of blindness.⁴ Although the majority of cases diagnosed in this survey were primary open angle glaucoma (POAG), the importance of primary angle closure glaucoma (PACG) is underlined by the fact that PACG has a greater propensity to progress to blindness.³ Primary angle closure may present with symptoms (acute angle closure, AAC) or without (chronic angle closure, CAC). Symptomatic episodes occur in between 25% and 50% of people affected by angle closure.^{4–6} A prospective, nationwide study of incidence of AAC in Singapore recorded a rate of 12.2 per 100 000 person years—the highest rate yet recorded.⁷ This figure was subsequently verified by study of national hospital discharge records.⁸

We were alarmed that half the cases of AAC identified in our prospective incidence study waited 3 or more days before presenting to an ophthalmologist. Late presentation has previously been linked with an adverse outcome, such as poor intraocular pressure (IOP) control.^{9, 10} Therefore, the aim of this study was to explore the health beliefs, and determine factors associated with glaucoma awareness and delay in presentation of patients with a first attack of AAC.

METHODS

Patients aged 35 years and above who presented with classic signs and symptoms of the first attack of AAC to the Singapore National Eye Centre (SNEC) and to the emergency ward of Singapore General Hospital from March 1999 to July 2001 were included in this prospective study. This study is part of a larger case-control study of the ocular risk factors associated with AAC. The SNEC is the largest tertiary eye centre in Singapore with approximately 56% of patients with AAC presenting to SNEC. Patients with secondary causes of acute glaucoma (such as an intumescent lens or iris neovascularisation), previous

intraocular surgery in the involved or contralateral eye, previous eye injury, and previous intraocular infection, were excluded. The participation rate in these interviews was 86%. Informed written consent in the patient's own language was obtained after the nature of the study was explained. Approval was obtained from the ethics committee, SNEC, the Johns Hopkins institutional review board, and the study procedures followed the tenets of the Declaration of Helsinki.

Questionnaire

Patients were interviewed face to face during the first hospital clinic visit by a trained interviewer using a standard questionnaire. The average time between interviews and the glaucoma attack was 90 hours (median 18 hours). The interview lasted about 20 minutes. The questionnaire was translated into the Chinese language. It was pilot tested in 24 patients and several questions were modified. The questionnaire asked about basic sociodemographic factors, awareness of eye disease, and risk factors for late presentation to the doctor. Health beliefs towards early presentation to the doctor for glaucoma were based on the health belief model.¹¹ The health belief model (adapted from the behavioural sciences) is one of the most widely recognised frameworks of health behaviour and may be applied to health seeking behaviour for AAC. The model explains how a person perceives the threat of AAC, and consequent loss of vision from glaucoma, and how he or she assesses the need for early presentation. The four constructs of the model are susceptibility, severity, benefits of taking action, and barriers to taking action. Questions about glaucoma awareness include whether the patients had heard of glaucoma before the attack, whether glaucoma was a serious condition that may damage vision, and whether glaucoma was treatable. Information on how long the patient would wait before seeing a doctor if he presented with certain eye symptoms (blurring of vision, pain or redness in the eye) was obtained. We asked about barriers to seeing a doctor early such

Table 1 Knowledge and awareness of glaucoma

	No (%)
Patients who have heard of glaucoma before the attack	
Yes	24 (22.9)
No	81 (77.1)
Patients who think that glaucoma is a serious condition which can damage their vision	
Yes	17 (16.2)
No	88 (83.8)
Patients who think that acute glaucoma is a treatable condition	
Yes	6 (5.7)
No	99 (94.3)
Patients who think that acute glaucoma may damage their vision	
Yes	20 (19.1)
No	85 (81.0)
Patients who will recover from glaucoma without seeing a doctor	
Definitely agree	1 (1.0)
Somewhat agree	21 (20.0)
Disagree	83 (79.1)
<i>Time delay a patient considers acceptable before presenting to a doctor for a particular eye symptom:</i>	
Sudden blurring of vision	
No wait	34 (32.4)
A day or two	47 (44.8)
>48 hours	24 (22.9)
Sudden painful eye	
No wait	68 (64.8)
A day or two	29 (27.6)
>48 hours	8 (7.6)
Sudden red eye	
No wait	38 (36.2)
A day or two	44 (41.9)
>48 hours	23 (21.9)

as the non-availability of transport and the lack of people to accompany the patient to the clinic.

Definition of acute angle closure

The estimated dates and times of the onset of symptoms and presentation at the clinic were noted. An episode of AAC was defined by an eye with an occluded angle with IOP of at least 25 mm Hg. Presence of at least one of the following symptoms was also required: sudden onset of ocular discomfort or pain, nausea and/or vomiting, and subjective blurring of vision of recent onset or an antecedent episode of intermittent blurring of vision with haloes. Other signs documented to confirm a case but not required for the case definition were corneal epithelial oedema, unreactive mid-dilated pupil, iris bombe, and conjunctival injection. IOP at the initial examination was measured using Goldmann applanation tonometry by an ophthalmologist.

Statistical analysis

Univariate and multivariate analyses were conducted using the commercially available statistical software program *STATA*, version 7.0.¹² Patients who were aware and unaware of glaucoma, as well as patients who presented to the doctor early (<24 hours) and late (24 hours or more) were compared. The χ^2 test was used to compare proportions and the non-parametric Wilcoxon rank sum test to compare medians. Multivariate logistic regression models estimating the factors that predict glaucoma awareness (yes or no) or late presentation (late versus early) were conducted, adjusting for other potential confounders. Estimates of the multivariate adjusted ORs and 95% confidence intervals (CI) were made. All p values reported are two tailed and significance is defined as $p < 0.05$. A sample size of 108 is needed for a two sided hypothesis to detect a proportion of glaucoma awareness of 0.2 in patients who were early presenters compared with 0.1 for patients who were late presenters, if the power ($1 - \alpha$) is 0.8 and type I error, α , is 0.05.

Table 2 Factors affecting glaucoma unawareness

	No	Proportion unaware of glaucoma (%)	p Value
Age (years)			
≤ 60	34	64.7	0.04
>60	71	83.1	
Sex			
Male	35	82.9	0.32
Female	70	74.3	
Completed educational level			
No formal education	65	83.1	0.009
Primary	16	81.3	
Secondary	19	68.4	
Pre-university, diploma, or tertiary	5	20.0	
Occupational status			
Working	35	60.0	0.003
Not working	70	85.7	
Family history of glaucoma			
Yes	3	33.3	0.07
No	102	78.4	

RESULTS

The average age of the people presenting with AAC in this study was 63.6 years (SD 10.1 years). There were 35 men and 70 women. The completed educational level of the patients was as follows: 61.9% had no formal education, 15.2% primary school education (ages 6–12 years), 18.1% secondary school education (ages 13–16 years), and 4.8% had completed pre-university or tertiary education (ages 17 years and above). The majority of AAC patients first saw the family physician after the attack (79.6%), while 19.4% saw the ophthalmologist and 1.0% saw the Chinese traditional medicine doctor. Most patients were referred by primary care physicians (61.7% private primary care physicians and 18.1% government primary care physicians) to the emergency department or hospital eye service. The average IOP in the worse eye at presentation was 54.5 (SD 12.0) mm Hg and the most common symptoms were blurring of vision (97.0%) and pain (92.1%), followed by vomiting (46.5%) and halos (17.8%).

Before the onset of symptoms, 22.9% of the patients had heard of glaucoma (Table 1); 67.7%, 35.2%, and 63.8% of patients did not know that sudden blurring of vision, painful eye and red eye, respectively, were symptoms that required medical attention. A sizeable proportion of patients (28.6%) had previously seen an eye specialist. However, only 8.6% saw the doctor for regular eye check ups.

Table 2 illustrates the factors related to lack of awareness of glaucoma. The ORs of glaucoma unawareness for older patients (>60 years) was 2.7 (95% CI 1.1 to 6.9), 4.0 (95% CI 1.5 to 10.4) for adults who were not working, and 16.0 (95% CI 1.7 to 151.1) for patients who had completed less than a pre-university education. Likewise, patients without a family history of glaucoma were more likely to be unaware of glaucoma, though this relation was only of borderline significance ($p=0.07$). Unawareness of glaucoma was not associated with sex ($p=0.32$), religion ($p=0.55$), whether the patient ever saw an eye specialist ($p=0.11$), or whether he or she saw a doctor for regular eye check ups ($p=0.11$). In multivariate logistic regression models, the adjusted OR of lack of awareness of glaucoma in older people (>60 years) was 1.5 (95% CI 0.5 to 4.6), 3.2 (95% CI 1.1 to 9.4) for adults who were not working, and 13.8 (95% CI 1.3 to 146.7) for patients who had less than a pre-university education (pre-university students are aged 17–18 years) (Table 3).

The average time between onset of symptoms and the clinic visit was 77 hours (median 16 hours; range 1–2208 hours). Medical advice was sought within 24 hours of onset of symptoms by 68.3% of the patients. The usual mode of transport was bus and light rail (67.2%), while 17.1% used a car and

Table 3 A logistic regression model of the predictors of unawareness of glaucoma

	Multivariate adjusted OR	95% CI
Age (years)		
≤60	1.0	0.5 to 4.6
>60	1.5	
Completed educational level		
Completed pre-university	1.0	1.3 to 146.7
Completed less than pre-university education	13.8	
Occupational status		
Working	1.0	1.1 to 9.4
Not working	3.2	

Table 4 Factors affecting patients who present late to the doctor

	Saw the doctor <24 hours* (n=71)	Saw the doctor ≥24 hours (n=33)	p Value
	No (%)	No (%)	
Age (years)			
Mean (SD)	63.9 (9.4)	62.5 (11.3)	0.63
Median (range)	64.0 (44.5–91.7)	61.9 (35.4–82.7)	
Sex			
Male	22 (62.9)	13 (37.1)	0.40
Female	49 (71.0)	20 (29.0)	
Language spoken			
English	17 (89.5)	2 (10.5)	0.03
Chinese	54 (63.5)	31 (36.5)	
Car available			
Yes	17 (94.4)	1 (5.6)	0.009
No	54 (62.8)	32 (37.2)	
People to accompany to hospital			
Yes	65 (71.4)	26 (28.6)	0.07
No	6 (46.2)	7 (53.9)	
Previously heard of "glaucoma"			
Yes	16 (66.7)	8 (33.3)	0.85
No	55 (68.8)	25 (31.3)	
Patients who think that glaucoma is a serious condition which can damage their vision			
Yes	14 (82.4)	3 (17.7)	0.17
No	57 (65.5)	30 (34.5)	

*Time from symptoms to presentation to the doctor was missing for one person.

6.7% a taxi. A small proportion of people (12.4%) did not have anybody to accompany them to the hospital.

Table 4 reports the factors associated with late presentation to the doctor. The ORs of late presentation (≥24 hours) was 10.1 (95% CI 1.3 to 79.3) if a car was not available, 4.9 (95% CI 1.1 to

22.5) for adults who spoke a Chinese language primarily, and 2.9 (95% CI 1.0 to 9.5) for people without anybody to accompany to the hospital. However, knowledge about the seriousness of glaucoma was not related to time of presentation to the doctor (p=0.17). Age, sex, educational level, housing type, total family income, family history of glaucoma, and previous visits to the eye specialist were not related to late presentation to the doctor. A multivariate logistic regression model was conducted with late presentation to the doctor (= 24 hours) as the dependent variable and availability of car, language spoken, and whether there was someone to accompany the person to hospital as the covariates. The multivariate adjusted ORs were 8.5 (95% CI 1.04 to 69.5) if there was no car available, 5.0 (95% CI 2.0 to 25.6) if the patient spoke Chinese primarily, and 3.3 (95% CI 0.9 to 11.9) if there was no accompanying person.

DISCUSSION

This is a unique study of the awareness of risks of visual loss, and health beliefs of patients with primary AAC. A relatively small proportion of patients suffering AAC in Singapore had previously heard of glaucoma, or realised that glaucoma is a treatable, potentially blinding or serious condition. On the whole, patients had poor knowledge that the presentation of eye symptoms such as sudden blurring of vision would warrant a visit to the doctor within 24 hours. In contrast, a community survey revealed that 73.1% of adult Singapore women were aware of Papanicolaou smear for cervical cancer screening and 96.4% knew that cancer was a serious disease.¹³ In our study, glaucoma awareness was much lower than in the United States but higher than in India. The proportion of adults from the eye clinics and from communities in the United States who had heard of glaucoma was 72%¹⁴ and 70–93%, respectively (Table 5).^{14–18} In the population based Andhra Pradesh Eye Disease study of 1859 adults above 15 years of age, 2.3% had heard of glaucoma, but 69.8% had heard of cataract and 60% had heard of night blindness.¹⁵ In a survey of 3654 Australian adults aged 49 years and older, 93% of the adults were aware of glaucoma, 98% of cataract but only 20% had heard of age related macular degeneration.¹⁶

Patients suffering episodes of AAC who were older, had lower levels of educational achievement, or who were unemployed were less likely to be aware of glaucoma. Similar patterns were found in the United States and Australia where less formally educated adults were less likely to know about the disease.^{14–16} Education level, a possible surrogate of socioeconomic status, may also be linked to access to health care. Thus, patients with poor knowledge of glaucoma may include a high risk group of patients with limited medical care access.

Late presentation to the doctor appears to be a significant problem in AAC patients in Singapore. A significant proportion of glaucoma patients in the United Kingdom present with severe glaucomatous visual field loss at first clinic visit.¹⁹

Table 5 The awareness of glaucoma in different countries

Author (year)	Country	Study population	Awareness of glaucoma
Dandona <i>et al</i> (2001) ¹⁵	India	Community All ages	2.3%
Gasch <i>et al</i> (2000) ¹⁴	United States	General eye service patients All ages	72%
Attebo <i>et al</i> (1997) ¹⁶	Australia	Community Adults above 49 years of age	93%
Livingston <i>et al</i> (1995) ¹⁷	Australia	Community Adults above 40 years of age	70%
Michielutte <i>et al</i> (1984) ¹⁸	United States	Community Above 14 years	81%
Saw <i>et al</i> (current study)	Singapore	Tertiary eye hospital patients Adults 35 years and above	23%

AAC patients who seek medical treatment late after the first onset of symptoms have worse outcomes, such as a higher risk of persistently elevated IOP.^{9,10} In the United Kingdom, glaucoma patients who present late have a significantly higher risk of subsequent blindness.¹⁹

It is our belief that by identifying factors associated with late presentation, health education may be targeted at the highest risk groups. By raising awareness in these groups, we hope to begin reducing the problem of late presentation among people with AAC, and consequently reduce the rate of visual loss.

The rates of AAC in Asia are among the highest in the world,^{3,4} but there are scarce data on the factors associated with late presentation in Asian populations. Using constructs from the health belief model, factors identified include specific barriers to early presentation such as car access (perceived barriers).¹¹ Specific barriers to early presentation, but not perceived seriousness of glaucoma, influenced the time of presentation to the doctor. One example of such a barrier, which was the inability to find someone to accompany the person to the hospital, may be of particular importance in Asian cultures where elderly adults are often dependent on immediate family members for assistance. Patients who lack transport by car tend to present late. Although Singapore is a small urban country and most hospitals are readily accessible, alternative modes of transportation such as buses or the underground train may not be convenient for elderly patients who may have decreased mobility. The government, through public education efforts could educate neighbours, friends, and relatives to assist in providing transport. Car access may be linked to socioeconomic status and a previous study revealed that both lower socioeconomic status and lack of car access were associated with late presentation for glaucoma.²⁰ In a study of 897 amblyopia clinic patients, children with lower socioeconomic status tend to seek medical attention late.²¹ One possible reason why Chinese speaking patients present later than English speaking patients is that health education messages using different media such as videos, pamphlets, and posters are written most frequently in English (In Singapore, English is the primary language in schools and in the workplace, whereas Chinese may be spoken at home or during leisure activities). Measures should be taken to develop and disseminate media tools in other written languages such as Chinese. In our present study, age, sex, previous eye care, and level of presenting IOP were not associated with late presentation.

Our study suggests that the public should be educated about the necessity of seeking medical treatment early if certain eye symptoms such as sudden blurring of vision occurred, as well as information about glaucoma, the seriousness of glaucoma, and the availability of effective treatment. An interesting finding is that 28.6% of the patients had previously seen an eye specialist, but of these only a third of patients had heard of glaucoma. Medical professionals are perhaps missing an opportunity for health education about this important disease. Effective educational programmes may diminish the medical and socioeconomic burden of glaucoma by encouraging adults to seek appropriate medical treatment. Increasing the awareness of treatment for glaucoma may encourage early presentation to the doctor and thus lessen complications and visual loss associated with severe glaucoma.

In conclusion, a small proportion (22.9%) of AAC patients had previously heard of the term "glaucoma," and only 32.4% were aware that specific eye symptoms would necessitate early medical attention. The lack of knowledge about the need to seek medical attention with certain eye symptoms, and not specific information on glaucoma, was associated with late presentation to the doctor. Other barriers to early presentation include lack of a car, no accompanying person and being conversant primarily in Chinese rather than in English. The generalisability of our findings, however, may be limited as the patients of only one tertiary hospital were included. Nationwide education programmes in local languages that increase

the level of awareness of eye symptoms and glaucoma should be targeted at the elderly with less formal education and the unemployed. It is possible that increased education may lower the burden of this potentially blinding disease.

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