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Epidemiology of acute primary angle-closure glaucoma in the Hong Kong Chinese population: prospective study

香港華人中急性原發閉角形青光眼的流行病學：預期研究

Objectives. To determine the incidence of acute primary angle-closure glaucoma in the Hong Kong Chinese population, and to identify risk factors for this condition.

Design. Prospective study.

Setting. University teaching hospital, Hong Kong.

Participants. Patients with acute primary angle-closure glaucoma presenting between 1 March 1998 and 29 February 2000.

Main outcome measures. Demographic data, presenting symptoms and signs, temporal details of the presentation, and precipitating factors. The crude regional incidence was calculated according to the Hong Kong population census of 1991 and the age-specific incidence was calculated.

Results. Seventy-two cases (72 eyes of 72 patients) of acute primary angle-closure glaucoma were recruited. The crude incidence was 10.4 per 100 000 per year in the population aged 30 years and older. Patients at higher risk of attacks were those aged 70 years or older (age-specific incidence, 58.7 per 100 000 per year) and females, who had a relative risk of 3.8 compared with males (95% confidence intervals, 1.7-8.4). Only four (5.6%) patients had a positive family history of acute primary angle-closure glaucoma. Seventeen (23.6%) patients were noted to have an upper respiratory tract infection before the attack, and 25 (34.7%) patients had taken antitussive agents. There was a statistically significant inverse correlation between the monthly attack rate and the monthly rate of influenza (Spearman's rank correlation coefficient = -0.388; P=0.031).

Conclusion. There is a high incidence of acute primary angle-closure glaucoma among Chinese residents of Hong Kong, with elderly females at highest risk. A significant proportion of patients reported upper respiratory tract infection or the use of antitussive medication prior to attacks.

Key words:

Acute angle-closure glaucoma;
 Epidemiology

關鍵詞：

急性閉角形青光眼；
 流行病學

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目的：確定急性原發閉角形青光眼在香港華人口中的發病率，並指出造成此情況的危險因素。

設計：預期的地區發病率研究。

安排：香港；大學教學醫院。

參與者：1998年3月1日到2000年2月29日之間出現急性原發閉角形青光眼的患者。

主要結果測量：人口統計學數據，呈現的徵狀和跡象，呈現的時間性細節及促成因素。總地區發病率根據1991年香港人口普查計算，並計算了按年齡分佈的發病率。

結果：72個(72名患者的72隻眼睛)患急性原發閉角形青光眼的病例中。30歲及以上人口的總發病率是每年十萬分之10.4。高危患者是70歲以上

的老年人(該年齡組別的發病率是每年十萬分之 58.7)和女性，女性的發病率是男性的 3.8 倍 (95% 置信區間，1.7-8.4)。只有 4 名(5.6%)患者有家族急性原發閉角形青光眼病史。17 名(23.6%)患者在病發前有上呼吸道感染，25 名(34.7%)患者曾服用止咳藥。在月發病率和月流行性感冒率之間在統計學上有顯著的反比關係(Spearman 分級相關係數 = -0.388 ; P = 0.031)。

結論：急性原發閉角形青光眼在香港華人居民中的發病率很高，其中以老年婦女的發病危險最高。報告中，有相當比例的患者在併發前有上呼吸道感染或曾服用止咳藥。

Introduction

Glaucoma is the second most common cause of blindness in the world.¹ The epidemiology of glaucoma in Caucasians has been well documented by several major population-based surveys—in particular, the Wales and Bedford studies (1966 to 1968), the Framingham studies (1973 to 1975), and the Baltimore Survey (1985 to 1988).²⁻⁵ There is no doubt that primary open angle glaucoma is the most common form of glaucoma in Caucasians, whereas primary angle-closure glaucoma (PACG) is relatively rare. In the local Hong Kong Chinese population, PACG—whether acute or chronic—appears to be more common than in the West. Studies in the South-East Asian region to date, have confirmed a high incidence of angle-closure glaucoma in these populations.⁶⁻⁹ The prevalence of PACG is known to be race-dependent, being lowest (0.1%) in Caucasians and highest (2% to 8%) in the Inuit population.⁷ Epidemiological data concerning acute forms of PACG in Asians and Orientals are currently lacking. This prospective study aimed to document the epidemiology, including risk factors contributing to acute PACG development, in the Hong Kong Chinese population.

Methods

Patients who presented to the Prince of Wales Hospital (PWH) from 1 March 1998 to 29 February 2000, with acute attacks of PACG, were included in this study. Inclusion criteria included:

- (1) At least one symptom typical of acute PACG, such as pain, blurred vision, seeing halos, nausea, and/or vomiting;
- (2) At least four of the following signs: corneal oedema, unreactive mid-dilated pupil, iris bombé, ciliary flush, and intraocular pressure greater than 20 mm Hg; and
- (3) A completely occluded drainage angle in the affected eye or a very narrow angle in the fellow eye capable of closure, as confirmed by gonioscopy.

Patients with plateau iris syndrome or secondary forms of angle-closure glaucoma were excluded. All

patients signed an informed consent form prior to data collection. Demographic data, presenting ocular and systemic symptoms, and chronological details of presentation were collected. Special attention was paid to each patient's medical, ophthalmic, and family history. A standard data record sheet was designed to collect data.

The population studied included individuals aged 30 years or older, who lived in the Shatin and Tai Po districts of Hong Kong (according to the Hong Kong population census 1991). The crude regional incidence was calculated accordingly. Patients were stratified according to their age, and the age-specific incidence was calculated. The monthly acute PACG attack rate was also compared to daily global solar radiation records, and the month-to-month incidence of influenza. Correlation analysis was performed using the Spearman's rank correlation test.

Results

During the study period, 72 eyes (of 72 patients) with acute PACG were studied (Fig 1). All patients were ethnic Chinese, and all but one were Hong Kong permanent residents. The mean age at presentation was 68.2 years (standard deviation [SD], 10.9 years). The ratio of affected females to males was 3.8:1 (57 females versus 15 males), and the relative risk of females developing acute PACG compared with males was 3.8 (95% confidence interval, 1.7 to 8.4). There were 35 (48.6%) right eyes and 37 (51.4%) left eyes. No patient presented with simultaneous bilateral acute PACG in this series.

Fifty-three (73.6%) patients reported that the onset of the acute attack was between noon and midnight. Forty-nine (68.1%) patients sought medical attention within 24 hours from the onset of symptoms, whereas eight (11.1%) waited more than 1 week before their consultation. The remaining 15 patients presented between 24 hours to 1 week.

The two most common presenting symptoms were a decrease in visual acuity and ocular pain (Table 1).

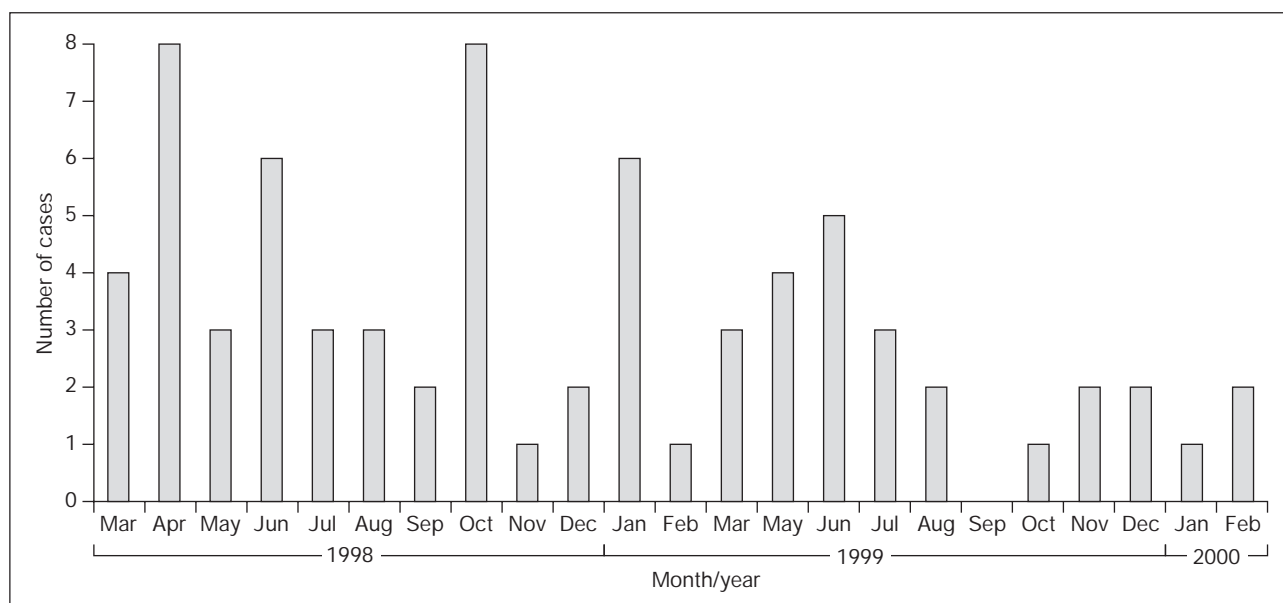


Fig 1. Monthly incidence of acute primary angle-closure glaucoma cases at the Prince of Wales Hospital between 1 March 1998 and 29 February 2000

Two (2.8%) patients presented with vague symptoms, such as mild impairment of visual acuity. Presenting visual acuity ranged from 20/50 to no perception of light, with 58 (80.6%) patients presenting with a visual acuity of 20/200 or worse. The mean intraocular pressure at presentation was 60 mm Hg (SD, 10 mm Hg), with a range from 41 to 80 mm Hg. More than 60% of patients presented with an intraocular pressure of 60 mm Hg or above. A substantial proportion of patients (23.6%) had concurrent diabetes mellitus and/or hypertension.

Four (5.6%) patients developed acute PACG after pharmacological dilatation of the pupil for fundal examination, whereas the remaining 68 patients were not using topical drugs prior to their attack. All patients who developed acute PACG after pupil dilatation had acute attacks in one eye only. Four (5.6%) patients had a positive family history of acute glaucoma. Seventeen (23.6%) patients had a history or symptoms compatible with upper respiratory tract infection, and six (35.3%) of these patients had taken commercial anti-tussive preparations before the attack. Analysis showed that monthly cases of acute PACG and reported cases of influenza¹⁰ were inversely related at the $P=0.05$ level of

Table 1. Presenting symptoms of patients with acute primary angle-closure glaucoma

| Symptoms | Patients, n=72 No. (%) |
|------------------------------|---------------------------|
| Decrease in visual acuity | 62 (86.1) |
| Ocular pain | 59 (81.9) |
| Headache | 26 (36.1) |
| Others (eg nausea, vomiting) | 20 (27.8) |
| Vague symptoms | 2 (2.8) |

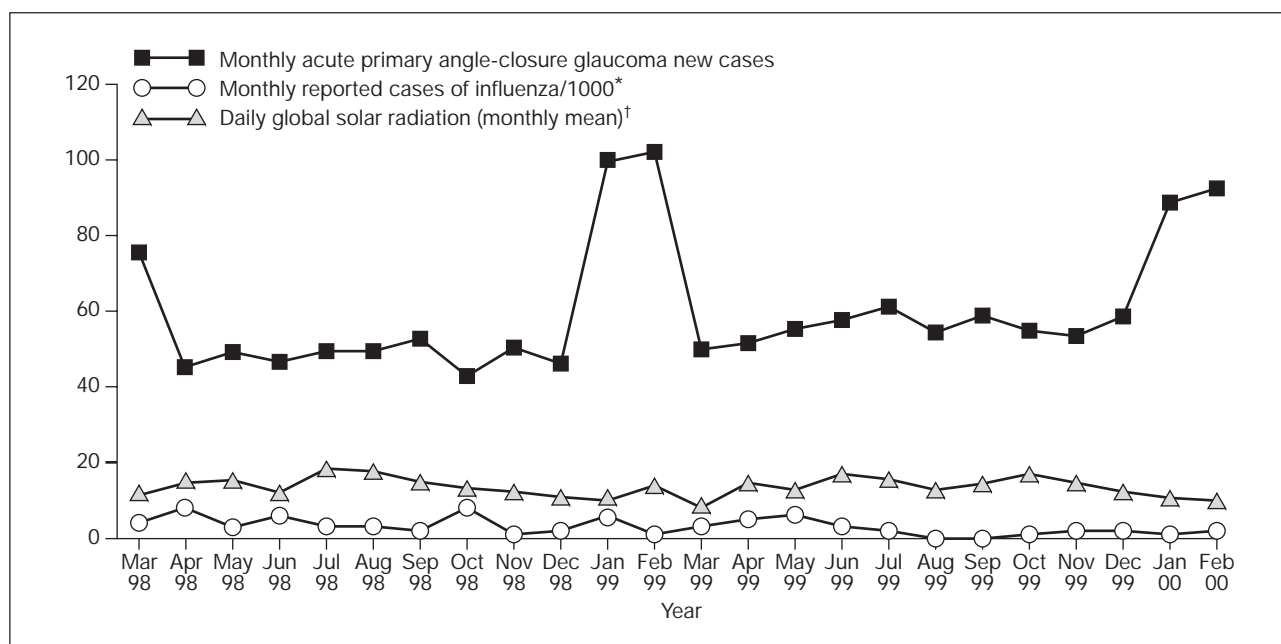
significance (Fig 2), with a Spearman's rank correlation coefficient (r) derived of -0.388 ($P=0.031$, 1-tailed).

The overall incidence of PACG was 10.4 cases per 100000 population per year. People aged 70 years or older were 12 times ($P<0.01$) more susceptible than people aged 69 years or younger. A statistically significant correlation was not seen between the number of monthly cases of acute PACG and the daily global solar radiation ($r=0.015$; $P=0.473$, 1-tailed), although a weak inverse association ($r=-0.023$) was found (Fig 2).

Discussion

Acute PACG is a relatively common eye emergency in the Chinese population, but little is known of its epidemiology in this locality.⁶⁻⁹ Acute PACG is highly symptomatic and potentially blinding. This has been appreciated since von Graefe's iridectomy in 1856.¹¹ Gonioscopic findings have suggested pupillary block as a possible mechanism for acute PACG.¹¹ The visual prognosis for patients with acute PACG is uncertain.^{12,13} The probability of monocular blindness in Caucasian populations at the time of diagnosis and 5 years post-diagnosis is reported to be 14% and 4%, respectively.¹⁴ Data on the epidemiology and long-term visual outcome following acute PACG in Asians is far from complete. The extrapolation of data from Caucasian populations is unreliable because of the large dissimilarity in glaucoma pattern between different ethnic groups (Table 2).^{6,8,9,15-21}

In this study, both age (70 years or older) and sex (female) were found to be major risk factors for acute



* Data from Department of Health

† Data from Hong Kong Observatory

Fig 2. The correlation between the monthly incidence of acute primary angle-closure glaucoma, solar radiation flux, and the incidence of influenza

PACG. These findings agree with those from an earlier study conducted in Singapore.⁶ Most (68.1%) patients in this study presented within 24 hours after the onset of symptoms, with only 11.1% waiting more than 1 week before presentation. This is an encouraging finding and may reflect the high availability of low-cost emergency ophthalmic services in Hong Kong through the public health care system. Seventy-five percent (54/72) of patients in this series presented directly to public services, whereas the remaining 25% (18/72) attended private doctors before being referred to the PWH. These figures may also reflect the severity of acute PACG symptoms, and the high level of public awareness of this condition. A substantial proportion of patients (23.6%) also had diabetes mellitus

and/or hypertension. Whether this observation is due to an association between these conditions and acute PACG, or simply due to the high prevalence of these medical conditions in Hong Kong, remains to be determined. The incidence of positive family history noted was unexpectedly low and possibly reflects underdiagnosis of PACG in the past.

Among patients who had an upper respiratory tract infection prior to an acute PACG attack, a significant proportion (35.6%) had also taken antitussive agents. These medications may contain anticholinergic components that can induce mydriasis and closure of a predisposed narrow angle. Overall analysis, however, showed an inverse correlation between the monthly

Table 2. Summary of epidemiological studies on acute primary angle-closure glaucoma

| Year of study | Ethnicity | Age | Number | Prevalence | Proportion of primary acute glaucoma cases among those with primary glaucoma (%) | Incidence (per year) |
|---------------|----------------------------------|-----------|--------|---------------------------------|--|----------------------|
| 1976 | Eskimos, Greenland ¹⁵ | >40 years | 1072 | 5.1% (females), 1.6% (males) | — | — |
| 1979 | Chinese, Singapore ⁸ | — | 167 | — | 79 | — |
| 1984 | Eskimos, Alaska ¹⁶ | — | 7036 | 2.12% | — | — |
| 1985 | Chinese, China ¹⁷ | — | 677 | — | 74.7 | — |
| 1987 | Eskimos, Alaska ¹⁸ | >40 years | 377 | 2.65% | — | — |
| 1988 | Eskimos, Greenland ¹⁹ | >40 years | 344 | 10% (females), 2% (males) | — | — |
| 1988 | Eskimos, Alaska ²⁰ | >40 years | 368 | 5.5% (females), 2.1% (males) | — | — |
| 1990 | Chinese, Taiwan ²¹ | — | 1627 | — | 78 | — |
| 1997 | Chinese, Singapore ⁶ | >30 years | 189 | — | — | 12.2/100 000 |
| 1998 | Chinese, Singapore ⁹ | >60 years | 479 | 4.8% | — | — |

acute PACG attack rate and the reported incidence of influenza. This observation might be explained by several important confounding factors. Firstly, there is evident difficulty in documenting all new cases of influenza in a heavily populated city, such as Hong Kong. Secondly, the high rate and early availability of cataract extraction for elderly patients serviced by the PWH may have prevented acute PACG in many patients who would otherwise have been predisposed to this condition by a narrow angle. Extraction of a cataract can dramatically deepen the anterior chamber and widen the drainage angle, thus preventing PACG. In addition, the incidence of acute PACG has decreased recently, making it more difficult to document correlations between this condition and environmental factors. The lack of age stratification in the reporting of influenza data may also preclude accurate comparison with acute PACG incidence figures.

The crude incidence of acute PACG derived from this study was 10.4 cases per 100000 per year, whereas the incidence in Singapore is reported to be 12.2 per 100000 per year.⁶ Statistical comparison of these two populations requires age and sex adjustment based upon the population strata, however.

Although an association between the incidence of acute PACG and the frequency of sunspots or solar radiation flux has been reported in the literature, this remains to be fully elucidated.²²⁻²⁵ This study observed only a weak association between solar radiation flux and the acute PACG attack rate, which is not in keeping with findings from the Singaporean study and studies from the Arctic region.^{6,22-25}

Finally, determining the true incidence for a given condition requires recruiting all patients who are labelled as having the disease during a defined period. This study has limitations in this regard. Firstly, the PWH serves a defined territory within Hong Kong, namely the eastern New Territories region. Patients presenting to private doctors or other public institutes within or outside the region were not recruited in this study. Secondly, patients presenting in an emergency setting with a more acute and dramatic presentation may have been recruited, excluding those with a milder form of the disease. In the future, the aim is to collaborate with other ophthalmology departments within Hong Kong, and beyond as indicated, to conduct an epidemiological study on this important disease within a much larger study population. In this way, further insights into risk factors underlying acute PACG, potential prevention strategies, and the visual prognosis for patients with acute PACG can be determined.

Conclusion

There is a high incidence of acute primary angle-closure glaucoma in the Hong Kong Chinese population, with elderly females being the highest risk group. Hong Kong Chinese are at higher risk than Caucasians. A substantive proportion of patients reported upper respiratory tract infection or the use of antitussive medication prior to attacks.

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