

# Allergic Conjunctivitis

Panida Kosrirukvongs<sup>1</sup>, Nualanong Visitsunthorn<sup>2</sup>, Pakit Vichyanond<sup>2</sup> and Chaweewan Bunnag<sup>3</sup>

Conjunctivitis is one of the most common eye problems in general ophthalmic practice in Thailand, accounting for 14% of all eye diseases.<sup>1</sup> Its causes include infections with bacteria and viruses, and allergic conjunctivitis. Prevalence, causative agents, and clinical course of allergic conjunctivitis (AC) have not been studied in Thailand. Allergic conjunctivitis could be categorized as seasonal allergic conjunctivitis (SAC), perennial allergic conjunctivitis (PAC), atopic keratoconjunctivitis (AKC), vernal keratoconjunctivitis (VKC), and giant papillary conjunctivitis (GPC).<sup>2</sup> In mild cases of AC, SAC and PAC, there is a rapid onset of ocular itching, redness, burning and lacrimation. These conditions could lead to personality and behavioral changes since patients commonly keep their faces away from the light, with increased blinking in severe cases of AC, especially VKC.

Severe cases of VKC and AKC have bilateral eye involvement including keratopathy, superficial fibrovascular pannus, keratitis, and

**SUMMARY** The purpose of this research is to study the clinical features and risk factors of various types of allergic conjunctivitis. Four hundred and forty-five patients with a history of itching, foreign body sensation, lacrimation and red eyes were examined, and a skin test was performed and assessed to grade the severity. The mean age of the subjects was  $24.5 \pm 16.3$  years with female preponderance, except for vernal keratoconjunctivitis. The majority of the patients had perennial allergic conjunctivitis. Ninety-five percent of the patients had associated allergic diseases, especially allergic rhinitis. Sixty-six percent of the patients had a family history of atopy. Most patients had symptoms at night. Symptoms persisted throughout the year and were generally triggered by exposure to house dust. The allergy skin tests to common aero-allergens were positive in 95% of patients tested. Common allergens causing sensitization were house-dust mites, house dust, cockroaches, and grass pollen. Environmental control and avoidance of these allergens should be stressed in the management of these conditions.

shield ulcer, which can persist for weeks or months, affecting not only the patients' visual function but also their ability to lead a normal life.<sup>3</sup> For example, affected patients may not be able to attend school, college or work during an acute attack. This has a detrimental effect on their education and job prospects, leading to financial and mental health problems.

Allergic conjunctivitis could result from type I and type IV hypersensitivity reactions of the ocular surface after exposure to a

variety of airborne allergens arising in the home, from food, or other sources.<sup>4</sup> Investigation of these causes is necessary to guide an appropriate treatment and management. Several studies reported concomitant allergic rhinitis, asthma, eczema and family history of atopy, but these associations have not been studied in Thailand. Recur-

From the <sup>1</sup>Department of Ophthalmology, <sup>2</sup>Department of Pediatrics and <sup>3</sup>Department of Oto-rhinolaryngology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand.

Correspondence: Panida Kosrirukvongs

rences may occur if allergens are not identified and avoided. The diagnosis of allergic conjunctivitis may be made on the basis of a typical history of ocular and periorcular itching, redness, swollen eyelids, foreign body sensation and chemosis throughout the allergy attack with exacerbation and remission.<sup>4</sup> Skin prick tests are helpful in establishing a definite diagnosis. However, conjunctival scraping stained with modified Wright Giemsa stain to look for eosinophil in cooperative patient is a helpful diagnostic test. Early diagnosis and management will ameliorate the symptoms and restore good vision. Improving corneal opacity promotes a rapid return to health, making it possible for the patient to study and work again.

The purpose of this study is to analyze the clinical features, risk factors and clinical course of various types of allergic conjunctivitis found among Thai patients.

## MATERIALS AND METHODS

Four hundred and forty-five patients with a history of red eye, itching, foreign body sensation swollen eyelid and lacrimation or suspected allergic conjunctivitis aged over three years were included and examined for confirmation of the diagnosis and for determination of its severity with a slit lamp biomicroscope, and skin prick test at Siriraj Hospital from October 1998 to July 2000. Skin prick tests were performed and evaluated as previous recommendations.<sup>5</sup> Children aged less than 6 years were tested with 8 allergens, but older patients with no infirmity tolerated up to 30 allergens. Patients with associated atopic diseases such as asthma, allergic rhinitis, eczema or positive skin test were also enrolled

in the study. The exclusion criteria were bacterial conjunctivitis, viral conjunctivitis and toxic conjunctivitis. Positive eye findings were assessed for grading the severity of lid swelling, papillae or follicles at the palpebral conjunctiva, erythema, chemosis, cornea with superficial fibrovascular pannus, and punctate epithelial keratitis as 0 = none, 1 = mild, 2 = moderate and 3 = severe. Chemosis was assessed on the following scale: 0 = none, 1 = mild (conjunctiva separated from the sclera), 2 = moderate (raised conjunctiva especially at limbal area) and 3 = severe (ballooning of the conjunctiva). Papillae on upper tarsus were assessed on the following scale: 0 = no papillary reaction, 1 = mild hyperemic scattered papillae < 0.2 mm, 2 = moderate diffuse hyperemic, swollen papillae 0.3 to 1 mm, 3 = severe papillae and 4 = hyperemic, swollen giant papillae > 1 mm. Epitheliopathy was assessed on the following scale: 1 = fine superficial epithelial defect < 1/2 cornea, 2 = diffuse fine superficial epithelial defect > 1/2 cornea, 3 = confluent epithelial defect or mucous plaque and 4 = ulcer.

The size of the epithelial defect and/or ulcer and its location were assessed on the following scale: 1 = superior, 2 = inferior and 3 = centrally. Ulcer type was assessed on the scale: 1 = transparent ulcer base, 2 = transparent ulcer base and/or opaque white or yellow deposit and 3 = elevated plaque. Limbal infiltration was assessed on the following scale: 1 = mild prominent limbal vessels, 2 = moderate prominent limbal vessels, 3 = severe superficial fibrovascular pannus and 4 = 360° hyperemia and swelling.

Limbal scar, amount of Horner-Trantas dot, blepharitis and meibomitis were looked for and

graded as mild, moderate and severe. In VKC, fine papillae with limbal infiltration and Horner-Trantas dot were classified as limbal type, but giant papillae as palpebral type and a combination of them as mixed type.

All patients received environmental control advice and cold compression and topical antihistamine treatment.

## RESULTS

Four hundred and forty-five patients with allergic conjunctivitis were analyzed as shown in Table 1. The patients ranged in age from 2.8 to 74 years with a mean  $\pm$  SD of  $24.5 \pm 16.3$  years. There was a female preponderance (56.5%) with the exception of VKC in which most patients were male (83%) with at a younger age of 10 years with significant difference. One hundred and seventeen patients (26.3%) refused to perform a skin test. The majority (82%) of the patients had PAC. Among the severe cases of allergic conjunctivitis, 10.6% were VKC, 4.7% were AKC and 2.9% GPC. Fifty-one percent of all cases were students, whereas 82% of patients with GPC were in working age.

Sixty-six percent of patients had a family history of atopy of which 71.5% had allergic rhinitis mostly found in PAC and GPC, 24.4% asthma 12.5% atopic dermatitis in AKC, 10% urticaria and 5% conjunctivitis in VKC. The age of onset of allergic conjunctivitis ranged from 1 to 67 years with a mean age of  $20.3 \pm 15.2$  years. Only VKC patients had a significantly shorter mean age of onset of 6.5 years. The mean duration of AC was more than 4 years. GPC had a shorter duration of only 8 months.

**Table 1** Characteristics of each type of allergic conjunctivitis

	%				Total	p-value
	PAC	AKC	VKC	GPC		
Number	365	21	47	13	445	
%	81.8	4.7	10.6	2.9		
Age (years ± SD)	26.3 ± 16.4	27.0 ± 18.0	9.9 ± 5.0	28.3 ± 7.5	24.5 ± 16.3	< 0.001
(range)	(2.8-74)	(6-57)	(4-29)	(16-44)	(2.8-74)	
Sex: male	40.0	42.8	83.0	-	43.5	< 0.001
Occupation						< 0.001
Student	47.6	42.8	91.5	9.1	51.2	
Working	38.4	33.3	6.4	81.8	35.7	
Housework	14.0	23.8	2.1	9.1	13.1	
Family history of atopy	66.7	57.1	71.7	46.1	66.2	0.111
Allergic rhinitis	73.8	25.0	64.5	83.3	71.5	< 0.001
Asthma	24.4	37.5	22.6	16.7	24.4	0.271
Atopic dermatitis	-	12.5	-	-	0.4	< 0.001
Urticaria	0.9	-	9.7	-	1.9	< 0.001
Conjunctivitis	0.2	-	4.8	-	0.7	0.002
Sinusitis	1.3	-	-	-	1.1	0.339
Onset (years ± SD)	21.9 ± 15.4	23.6 ± 16.2	6.5 ± 3.4	27.1 ± 7.8	20.3 ± 15.2	< 0.001
(range)	(1-67)	(3-47)	(1-15)	(12-41)	(1-67)	
Mean duration (months ± SD)	60.2 ± 92.6	54.8 ± 59.6	41.3 ± 43.3	8.5 ± 9.9	53.9 ± 83.9	0.012
Duration						< 0.001
< 1 years	22.2	10.0	26.1	53.8	23.0	
1-5 years	57.1	60.0	54.3	46.2	56.6	
> 5 years	20.7	30.0	19.6	-	20.4	
Frequency of symptoms						0.001
Every day	24.9	38.1	45.5	42.3	28.3	
Every week	12.4	14.3	13.3	11.5	12.5	
Every month	32.1	19.0	34.4	15.4	31.2	
Others	30.6	28.6	6.8	30.8	28.0	
Associated allergic diseases	96.1	95.2	87.2	84.6	94.8	< 0.001
Allergic rhinitis	88.1	38.1	87.2	84.6	85.6	< 0.001
Asthma	16.5	19.0	10.6	7.7	15.8	0.284
Atopic dermatitis	10.5	76.2	8.5	23.1	13.7	< 0.001

**Table 2** Subjective grading of severity of allergic conjunctivitis by the patients

Severity	%				Total	p-value
	PAC	AKC	VKC	GPC		
Mild	46.8	40.0	14.9	46.1	43.1	< 0.001
Moderate	33.6	40.0	21.3	23.1	32.3	
Severe	19.5	20.0	63.8	30.8	24.6	

**Table 3** Comparison of symptoms of allergic conjunctivitis occur at various time, season, trigger factor

	%				Total	p-value
	PAC	AKC	VKC	GPC		
<b>Time</b>						
Morning	45.8	33.3	34.0	23.1	43.3	0.011
Afternoon	36.5	33.3	36.2	38.5	36.3	0.974
Evening	39.5	52.4	57.4	76.9	43.1	< 0.001
Night	47.8	66.7	51.1	15.4	50.3	0.001
<b>Season</b>						
All year	63.4	47.6	68.1	53.8	62.9	< 0.001
Summer	10.3	38.1	23.4	15.4	13.2	
Winter	8.7	4.8	4.3	-	7.8	
Rainy	2.3	9.5	-	-	2.4	
Uncertain	15.2	-	4.2	30.8	13.8	
<b>Trigger</b>						
House dust	67.9	55.0	71.3	45.5	67.0	0.042
Hot weather	21.7	37.5	54.5	9.1	26.0	< 0.001
Wind	27.5	50.0	52.2	30.8	24.0	< 0.001
Cleaning house	17.8	5.0	6.5	-	15.5	0.001
Exercise	0.8	10.0	8.7	-	2.1	< 0.001
Contact lenses	3.8	-	2.2	84.6	6.0	< 0.001

The frequency of attacks in PAC was monthly, even daily in some patients. Most of the associated allergic diseases were allergic rhinitis except in AKC, where it was atopic dermatitis with slight correlation ( $r = 0.404$ ,  $p < 0.001$ ).

Most of the cases had mild severity of symptoms except for VKC where symptoms tended to be more severe (Table 2). Symptoms were common at night and in the morning and without significant seasonal variations through the year. The most common trigger was exposure to house dust. AKC patients generally had more symptoms at night, whereas patients with GPC suffered more in the evening. Symptoms of VKC were triggered by hot weather ( $r = 0.243$ ,  $p < 0.001$ ) and of GPC by contact

lenses (Table 3). Common symptoms of AC were itching 72.8%, lid swelling 55.2%, foreign body sensation 53.8%, lacrimation 48.5% and photophobia 36.3% (Table 4). Common signs of AC were chemosis 96.3%, small papillae on the palpebral conjunctiva of upper eyelid 82.6%, and conjunctival injection 20.5%. Giant papillae, pannus, epitheliopathy, limbal infiltration, Horner-Trantas dot and blepharitis were frequently found in VKC. The most common type of VKC was limbal (51.1%), followed by the palpebral type (38.3%) and mixed type 10.6%.

Allergy skin test was positive in 95% of the subjects who consented to the testing (Table 5). Common allergens were house-dust mites (70%), house dust (64%),

cockroaches (44%), grass (43%), insects (27%), fungi (27%), and food (22%). The most common allergens found sensitized by patients with PAC were house-dust mites (*Dermatophagoides pteronyssinus* is more than *Dermatophagoides farinae*) house dust, cockroaches, grass, and insects. Among AKC patients, house dust, house-dust mite, cockroach, grass, and insect were most common. The most prevalent allergens in patients with VKC were house-dust mites, (especially *Dermatophagoides farinae* is more common than *Dermatophagoides pteronyssinus*), grass, house dust, food (shrimp, fish) and cockroaches. Among GPC patients the most common allergens were house dust, house-dust mites, fungi (*Cladosporium*, *Alternaria*), cockroaches, cats, dogs, and food

**Table 4** Symptoms and signs of allergic conjunctivitis

	%					p-value
	PAC	AKC	VKC	GPC	Total	
Chemosis	96.8	88.2	95.6	96.2	96.3	< 0.001
Fine papillae	81.9	69.7	88.9	96.2	82.6	< 0.001
Itching	74.2	58.8	72.8	53.8	72.8	0.073
Swollen eyelid	55.5	38.2	66.7	30.8	55.2	0.053
Associated allergic rhinitis	57.4	29.4	44.6	42.3	54.3	0.002
Foreign body sensation	52.1	44.1	63.0	76.9	53.8	< 0.001
Lacrimation	47.9	44.1	58.7	30.8	48.5	< 0.001
Photophobia	33.8	44.1	55.4	23.1	36.3	< 0.001
Burning	33.5	35.3	26.1	30.8	32.6	0.607
Discharge	18.1	44.1	28.3	26.9	20.6	< 0.001
Red eye	15.5	29.4	53.3	19.2	20.5	< 0.001
Eye pain	13.2	11.8	13.0	3.8	12.8	0.934
Follicle	7.8	28.6	3.6	31.8	8.9	< 0.001
Blepharitis	7.5	8.8	21.1	-	8.8	< 0.001
Giant papillae	-	7.1	42.9	45.5	7.0	< 0.001
Meibomitis	8.3	-	2.2	-	7.0	0.152
Trantas dot	-	3.6	39.3	4.5	5.1	< 0.001
Limbal infiltrate	-	7.1	19.0	4.5	2.8	< 0.001
Epitheliopathy	0.5	-	16.7	-	2.5	< 0.001
Pannus	0.2	-	11.9	4.5	1.8	< 0.001

**Table 5** Comparison of allergens in allergic conjunctivitis

Skin test	%					p-value
	PAC	AKC	VKC	GPC	Total	
Positive	97.3	100.00	79.5	100.00	95.4	< 0.001
House-dust mite	70.2	60.0	71.8	83.3	70.1	0.462
House dust	67.5	64.3	42.1	83.3	64.4	< 0.001
Cockroach	44.3	60.0	30.8	66.7	43.8	0.001
Grass*	42.2	42.8	48.7	16.7	42.6	0.211
Orther grass pollen	37.0	20.0	29.5	-	34.4	0.010
Fungus	25.8	21.4	28.9	83.3	27.3	< 0.001
Insect	29.2	40.0	10.5	-	26.7	< 0.001
Food	20.5	14.3	31.6	33.3	22.0	0.091
Dog	19.3	21.4	13.1	33.3	18.9	0.329
Kapok	18.0	21.4	10.5	33.3	17.5	0.170
Mosquito	18.6	20.0	7.9	-	16.9	0.047
Ant	18.8	7.1	2.6	-	15.6	0.001
Cat	14.6	7.1	15.4	50.0	15.1	0.005
Careless weed	11.4	20.0	10.5	-	11.5	0.289

\*Bermuda, Johnson, Timothy grass

(shrimp, fish, pork). The house-dust allergen was slightly correlated with PAC ( $r = 0.130$ ,  $p = 0.001$ ), and VKC ( $r = -0.178$ ,  $p < 0.001$ ), but fungi were slightly correlated with GPC ( $r = 0.230$ ,  $p < 0.001$ ).

On average the largest allergic skin reactions in patients with AC were due to house-dust mites, especially *D. farinae*  $501.2 \pm 485.3$  mm<sup>2</sup>, in AKC  $983.3 \pm 651.7$  mm<sup>2</sup>, PAC  $573.0 \pm 463.7$  mm<sup>2</sup> ( $p < 0.001$ ). In VKC *D. pteronyssinus* caused the largest allergic skin reaction with  $313.8 \pm 293.6$  mm<sup>2</sup>, significantly different from others ( $p = 0.005$ ). In GPC, fungi caused the largest allergic skin reactions compared to others ( $p = 0.012$ ) with a correlation ( $r = 0.866$ ,  $p = 0.026$ ).

Other large allergic skin reactions in AC were caused by shrimp, especially in PAC with a size of  $479.7 \pm 379.6$  mm<sup>2</sup> ( $p = 0.036$ ,  $r = -0.625$ ,  $p < 0.001$ ), soy bean  $233.3 \pm 103.3$  ( $p = 0.023$ ,  $r = -0.845$ ,  $p = 0.001$ ). However, the size of the skin reactions to fungi correlated with the size of the skin reactions to house-dust ( $r = 1.000$ ,  $p < 0.001$ ), and inversely correlated with the size of the skin reactions to house-dust mites ( $r = -1.000$ ,  $p < 0.001$ ).

## DISCUSSION

Most patients with allergic conjunctivitis (AC) have other associated allergic diseases, especially allergic rhinitis. A family history of atopy may confirm a hereditary cause, although environmental factors may still play a role in recurrent attacks. Therefore, environmental control of house-dust mites, house-dust and cockroaches are the key measures to prevent and decrease the symptoms and signs of allergic conjunctivitis and allergic

rhinitis. Because of all year round attacks, perennial allergic conjunctivitis (PAC) is more often found than seasonal allergic conjunctivitis (SAC) which has attacks only in the pollen seasons. Therefore, the most common allergic conjunctivitis in our study was PAC, contrary to temperate climates, where SAC was the highest incidence. Most patients with AC have mild symptoms like itching and foreign body sensations which are triggered by dust and wind, and most commonly caused by allergens such as house-dust, house-dust mites, cockroaches, grass and weed pollen. Although these allergens correlate with each type of AC with statistical significance, the patients may have an allergy to various allergens at the same time causing varied symptoms. This means that the more positive result of the test of the allergen, the more symptoms encountered in terms of severity and frequency of attack.

A careful history taken with regard to age, sex, age at onset of the symptoms, seasonal variation and the duration of the condition, previous personal or family history of allergic diseases and the occurrence of previous or concomitant ocular or systemic diseases may give a clue to the diagnosis of severe types of AC and VKC, based on their typical clinical presentation. In our study males were predominantly affected (83%) which is similar to other studies (72-92%).<sup>6-10</sup> The mean age of the patients with VKC in our study was 10 years, slightly younger than in the studies (11 years) but older than in Dahan's study (7.5 years).<sup>8,10,11</sup> The age range varied from 4-29 years in our study with different types of VKC compared to those reports. In tropical and subtropical countries, the limbal type is common, like in

our study.<sup>8</sup> In temperate countries on the other hand, mixed types or palpebral types of VKC are the majority of cases.<sup>6,9</sup> Furthermore, corneal ulcer and plaque are frequently found in patients with the palpebral type of VKC. Therefore, risk of visual loss or decreased vision in temperate countries may be greater than in tropical countries. Furthermore, the limbal of VKC type is more common in Asian or black children.<sup>12</sup> Therefore, racial issues may be an interesting focus for further investigations. In 68% of our patients the symptoms are present throughout the year, contrary to other studies, where symptoms presented only in summer (35-55% of the year).<sup>6,8</sup> The seasonal variation in severity of symptoms in tropical countries is not marked and symptoms may persisted all year round, as the temperature does not vary significantly all through the year in Thailand. In South Africa and Israel, patients with VKC had a lower association with atopy (5-11%) such as asthma, allergic rhinitis, than in Thailand (87%), unlike in other tropical countries.<sup>6,8</sup> These may be due to poor socioeconomic and environmental control. The mean onset age in patients with VKC in our study is 6.5 years with a mean duration of 3.3 years despite great variations, similar to Dahan's study from South Africa (duration 3 years) and Neumann's report from Israel (duration 4 years).<sup>6,8,10</sup> Seventy-two percent of our patients have a history of atopy in the family, as opposed to 15%, 49% in other studies.<sup>6,10</sup> This may be due to multifactorial circumstances including environmental control, heavier pollution and dust.

Seventy-nine percent of patients with VKC have a positive skin test for allergens which is

more than Bonini's report of 58%.<sup>10</sup> Common allergens are house-dust mites, grass, house-dust and food. Fungi are found only in 29%, which is less than in Neumann's study (42%).<sup>6</sup> A cause of VKC other than allergy is uncertain, because skin prick tests in children were not performed as much as in adult patients.

The most common symptoms and signs of VKC include itching, foreign body sensations, lacrimation, photophobia, ropy mucous discharge, fine papillae on the upper tarsal conjunctiva, swollen eyelids and red eyes. Similar to Dahan's study, most cases are of the limbal type with marked itching, photophobia, mucous discharge and lacrimation.<sup>8</sup> Most patients with severe symptoms have corneal involvement 32-38%, corneal shield ulcers 9.7% and reduction of visual acuity from corneal scars 6%.<sup>6,7,10</sup> In our patients, less corneal epitheliopathy with shield ulcers are found (2.4%) because of a lower incidence of the palpebral type of VKC. Clinical observation suggests that VKC generally subsides with the onset of puberty, but one patient in this study aged 29 years still had symptoms and signs of the palpebral type with frequent recurrences and permanent severe visual impairment from steroid induced glaucoma in both eyes. Therefore, rapid diagnosis with detection of the possible allergen and proper management can prevent the recurrence as well as decrease the symptoms and avoid permanent loss of vision from neglect's.

The mean age of onset of the 21 patients with AKC in our study was 23.6 years, lower than in other reports (fifth decade).<sup>13</sup> These patients had a family history of

atopic dermatitis and asthma more often than patients with other types of AC. Furthermore, they had associated allergic diseases with atopic dermatitis rather than other types of AC. Therefore, thorough history taking is essential for probable diagnosis. The common symptoms of AKC are the same as PAC. The wooden eyelids with scale frequently found in AKC patients of older age (50-60 years) were not found in our younger patients because of more skin elasticity or texture in the young. Regarding the allergen, positive skin tests for cockroaches and insects in AKC were more predominant than in other types of AC. Therefore, performing skin tests with allergens are necessary in order to know the possible risk factor and prevent the possible cause by environmental control.

All patients with GPC associated with contact lenses were female, because of the personality and cosmetic reason for not wearing glasses. However, it was also associated with ocular prostheses and corneal suture.<sup>14</sup> The late onset of GPC is involved in working middle age with spending more time to take care of their contact lenses, but not enough to clean all the possible allergens or the cleaning solution or contact lenses itself. This results in a shorter duration of GPC, about 8 months, which is less than other types of AC, which usually persisted more than 3 years. All the symptoms of GPC occur everyday especially in the evening associated with allergic rhinitis possibly related to longer time of using contact lenses. The common symptoms and signs are foreign body sensation of upper eyelids, itching, fine and giant papillae, similar to other reports.<sup>14</sup> All patients with GPC have positive skin test results.

Common allergens are house dust, house-dust mites, fungi, cockroaches and cats which can be avoided by carefully cleaning the house. Although this can not be achieved in one day, it can be done every day. These procedures can help to decrease the symptoms and restore normal quality of life. From statistical analysis in this study, fungi are the allergen, slightly correlated with GPC with largest size of skin reaction compared to other types of AC, and correlated to the size of skin reactions to other allergens and house dust.

Therefore, environmental control, cleaning, and fresh air are important for prevention of AC. Patients with negative skin tests should undergo conjunctival scraping to look for eosinophils and/or mast cells which give a reaction involving immunoglobulin E for confirmation of the diseases. Itching, lid swelling, foreign body sensation, lacrimation and chemosis with small papillae on the upper eyelid may help with the diagnosis in the case that skin tests are refused.

#### ACKNOWLEDGEMENT

This work was supported by Siriraj Grant for Research Development and Medical Education, Faculty of Medicine Siriraj Hospital, Mahidol University. The authors have no proprietary interest in any of the instruments or materials used in this study.

#### REFERENCES

1. Dumavibhat P, Srisupan V, Yenjit W, *et al.* Research strategy: ophthalmic diseases. In: Bhamarapravati N, Tontisirin K, Porapaktham Y. eds, Strategic plan for health research. Bangkok, PA Living Co, 1998; pp. 194-211.
2. Pepose JS, Holland GN, Wilhelmus KR. eds, Ocular infection and immunity. St. Louis, Mosby, 1996; pp. 345-90.

3. Cameron JA. Shield ulcers and plaques of the cornea in vernal keratoconjunctivitis. *Ophthalmol* 1995; 102: 985-93.
4. Friedlaender MH. Allergic conjunctivitis. In: Krachmer JH, Mannis MJ, Holland EJ. eds, *Cornea and external disease: clinical diagnosis and management*. Vol. II, St. Louis, Mosby 1997; pp. 805-10.
5. American Academy of Allergy and Immunology. Position statement on allergen skin testing. *J Allergy Clin Immunol* 1993; 92: 636-7.
6. Neumann E, Gutmann MJ, Blumenkrantz N, Michaelson IC. A review of four hundred cases of vernal conjunctivitis. *Am J Ophthalmol* 1959; 47: 166-72.
7. Baryishak YR, Zavaro A, Monselise M, Samra Z, Sompolinsky D. Vernal keratoconjunctivitis in an Israeli group of patients and its treatment with sodium cromoglycate. *Br J Ophthalmol* 1982; 66: 118-22.
8. Dahan E, Appel R. Vernal keratoconjunctivitis in the black child and its response to therapy. *Br J Ophthalmol* 1983; 67: 688-92.
9. Ben Ezra D, Péér J, Brodsky M, Cohen E. Cyclosporine eyedrops for the treatment of severe vernal keratoconjunctivitis. *Am J Ophthalmol* 1986; 101: 278-82.
10. Bonini S, Bonini S, Lambiase A, *et al.* Vernal keratoconjunctivitis revisited. A case series of 195 patients with long-term follow up. *Ophthalmol* 2000; 107: 1157-63.
11. Tuft SJ, Cree IA, Woods M, Yorston D. Limbal vernal keratoconjunctivitis in the tropics. *Ophthalmol* 1998; 105: 1489-93.
12. Tuft SJ, Dart JKG, Kemeny M. Limbal vernal keratoconjunctivitis: clinical characteristics and immunoglobulin E expression compared with palpebral vernal. *Eye* 1989; 3: 420-7.
13. Berdy GJ. Atopic keratoconjunctivitis (AKC). *Acta Ophthalmol Scand* 1999; 77: 7-9.
14. Katelaris CH. Giant papillary conjunctivitis-A review. *Acta Ophthalmol Scand* 1999; 77: 17-20.