



ORIGINAL ARTICLES

Sinusitis in Thai Asthmatic Children

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Sinusitis has been shown to be higher among allergic patients, especially those with asthma, than in the general population. The lack of signs and symptoms of sinusitis in children, particularly in younger groups, results in underdiagnosis.¹ Radiographic diagnosis of sinusitis, first reported by Scheier in 1986, is one of the most reliable and commonly used diagnostic procedures even in the absence of suggestive clinical history and findings.^{2,3} Many studies have revealed a correlation between radiographic findings and diagnosis of sinusitis. From these studies, the criteria accepted for diagnosis of sinusitis are: (a) thickening of paranasal sinus mucosa 5 mm or more; (b) complete obliteration of sinuses; (c) air fluid level in the sinuses; and (d) sinus mucosal thickening with polyps or cystic formation in the sinus. These radiographic abnormalities are shown to be more common among children with asthma and allergic rhinitis than in the general population of the same age.⁴

The occurrence of sinusitis in Thai asthmatic children has not been reported and was therefore subjected to this randomized study.

SUMMARY The radiographic appearance of sinuses was studied in 146 Thai asthmatic patients aged 1-13 years. Forty-eight percent of cases showed sinusitis by the radiographic criteria. The maxillary sinus was most commonly involved (98.6%). Thirty-three percent had ethmoidal sinusitis and 7% of those with developed frontal sinuses had frontal sinusitis. Thirty-three percent had more than one sinus involved. Those with frontal sinusitis always had maxillary and/or ethmoidal involvement. Sixteen cases had signs and symptoms of sinusitis and all of the cases had the radiographic appearance of sinusitis. There was no correlation between the occurrence of sinusitis and duration or severity of asthma. There was no difference in the occurrence of sinusitis between those with or without allergic rhinitis. No correlation between severity of sinusitis and age of patients was observed.

MATERIALS AND METHODS

One hundred and forty-six Thai asthmatic children (aged 1-13 years) who were referred to the Allergic Clinic, Department of Pediatrics, Faculty of Medicine, Siriraj Hospital, Mahidol University were randomly selected for our study. Patients having upper respiratory tract infections within 2 weeks prior to or during the study were excluded. History and physical examination were performed and recorded. Complete blood count, differential white count, stool examination, chest X-ray and other specific tests for asthma (lung function test, skin test, or provocation test) were performed.

Radiologic study of sinuses was carried out in two views: occipito-mental (Waters) view and occipito-frontal (Caldwell) view. The radiographic appearance was graded according to severity and evaluated by a single radiologist who was not aware of the history or clinical symptoms throughout the study.

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Sinus conditions from the radiographs were graded as follows :

- 0 = Negative findings
- 1+ = Sinus wall thickening 1-2 mm
- 2+ = Sinus wall thickening > 2-5 mm
- 3+ = Sinus wall thickening > 5 mm to complete obliteration of air fluid level
- 4+ = Sinus wall thickening with polyp, cyst or polypoid degeneration.

Criteria for radiographic diagnosis of sinusitis were severity grades 3+ or 4+. Sinus abnormality was diagnosed when the severity grading was 1+ or 2+. Severity of asthma was graded as mild, moderate or severe as recommended by Ellis 1983.⁵ Allergic rhinitis was diagnosed by persistent of classical signs and symptoms. Most of the cases had been proved by nasal eosinophilia. Clinical signs and symptoms of sinusitis^{4,6} were also recorded.

The data were analyzed by standard Chi-square test and unpaired student's *t*-test. A *p* value < 0.05 was considered statistically significant.

RESULTS

On hundred and forty-six Thai asthmatic children were recruited into the study. Eighty-six percent showed some degree of abnormal sinus radiographs with severity grading 1+ or more and 69% had a severity grading of 2+ or more. Seventy

cases (48%) showed sinusitis by radiographic criteria described above. The characteristics of all subjects and those who had sinusitis by radiographic criteria are detailed in Table 1. The study population with and without sinusitis had a similar age and sex distribution, asthmatic

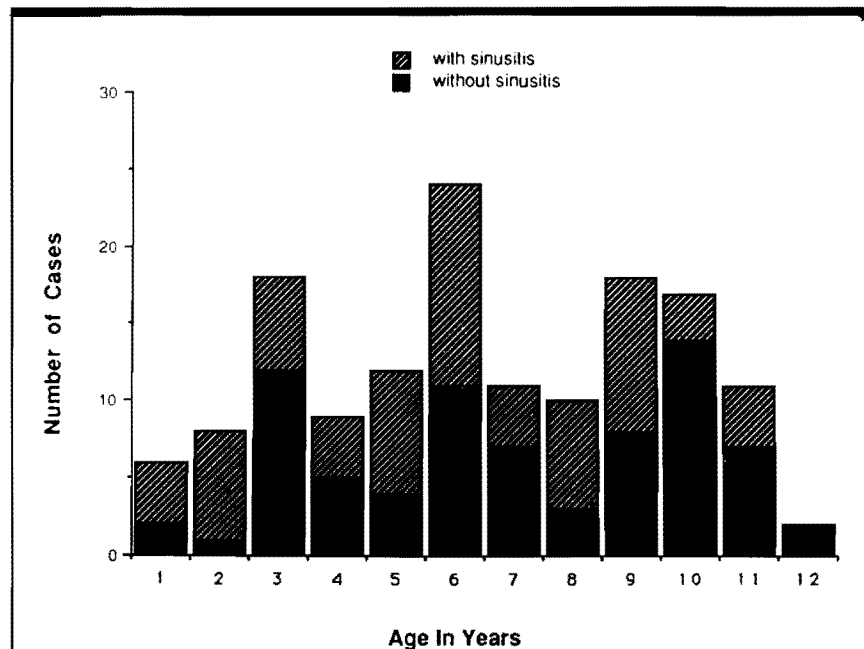


Fig. 1. Age distribution of Thai asthmatic children with and without sinusitis.

Table 1. Comparison of characteristics of all asthmatic patients receiving X-ray evaluation with patients having evidence of sinusitis.

	Total subjects	Subjects with sinusitis
No. of cases	146	70 (48%)
Sex, 1 male:female	1.5:1	1.5:1
Average age (years)	7 ⁴ /12	6 ⁸ /12
Average asthma duration (years)	2 ⁸ /12	3 ¹ /12
Severity of asthma		
Moderate (% of the cases)	33.6	34.3
Severe (% of the cases)	66.4	65.7
Patients with allergic rhinitis (%)	54.8	55.7
Cases with other atopic diseases* (%)	59	72.3
Allergic disease in family (%)	78.6	76.6

*Atopic dermatitis, urticaria or drug allergy

duration and severity, allergic diseases in the family and signs and symptoms of allergic rhinitis. The sinusitis group showed a higher percentage of history of other atopic diseases than those without sinusitis but the difference was statistically significant. The age distribution of Thai asthmatic children with and without sinusitis is shown in Fig. 1. The median age of the total population was 6 years. In this study, only 16 cases (11% of total cases) had signs and symptoms of sinusitis and all had positive diagnostic radiographs as shown in Table 2.

The distribution of type of sinus involvement was shown in Table 3 and Fig. 2. The maxillary sinus was the most commonly involved (98.6%) followed by the ethmoid sinus (33%) and the frontal sinus (4.3%). Those with frontal sinusitis always had maxillary and/or ethmoidal involvement. Among the cases with sinusitis, 33.3% had more than one sinus involved. Unilateral sinusitis was found in 13 patients (18.6% of cases). There were 45 cases with frontal sinus, which was

Table 2. Association between clinical and radiological sinusitis.

Clinical \ Radiograph	Sinusitis	No sinusitis	Total
	Sinusitis	16	0
No sinusitis	54	76	130
Total	70	76	146

Table 3. Asthmatic patients with sinusitis

Sinusitis	Cases	Per cent*
Total	70.0	100.0
Maxillary sinus	69.0	98.6
Right	8.0	11.4
Left	4.0	5.7
Bilateral	57.0	81.5
Ethmoidal sinus	23.0	33.0
Right	1.0	1.5
Left	0.0	0.0
Bilateral	22.0	31.5
Frontal sinus	3.0	4.3

*Some patients had sinusitis of more than one sinus

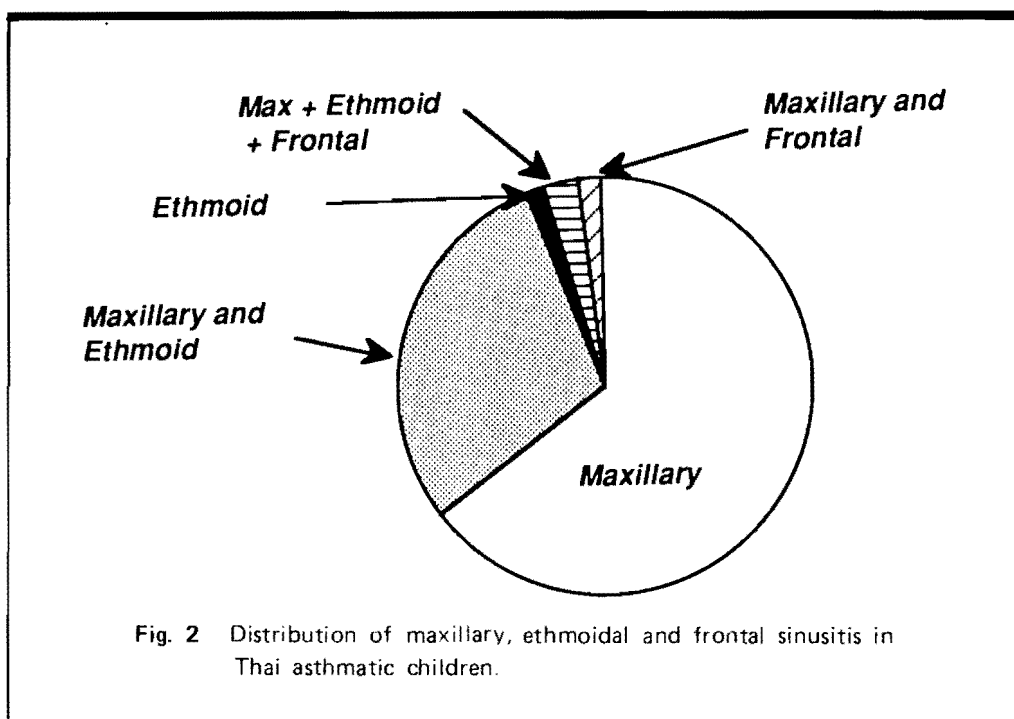


Fig. 2 Distribution of maxillary, ethmoidal and frontal sinusitis in Thai asthmatic children.

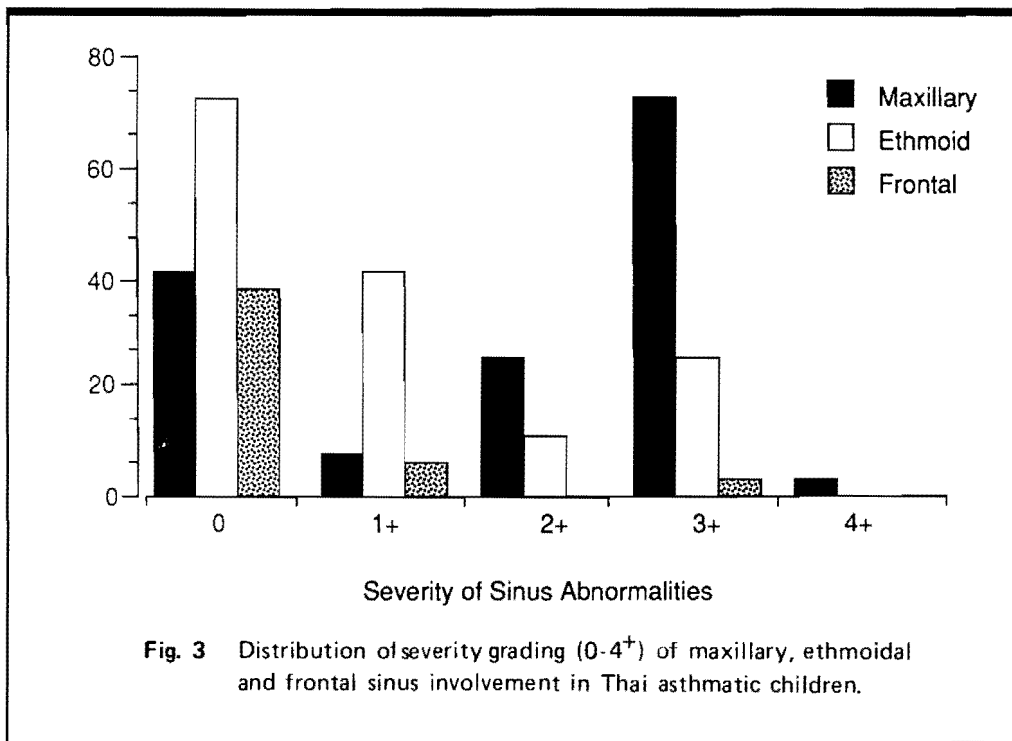


Table 4. Association between sinusitis and severity of asthma.

Asthma \ Severity of asthma	With sinusitis	Without sinusitis	Total
Moderate	24	25	49
Severe	46	51	97
Total	70	76	146

31% of all subjects. The minimum age of children with developed frontal sinuses in our study was 6 years and 1 month and the maximum age of children without frontal sinuses was 8 years. Frontal sinusitis was found in 7% of cases in which the frontal sinus was developed. The distribution of severity grade of sinusitis of each sinus type is shown in Fig. 3. Two-thirds of cases with abnormal maxillary sinus radiographs (1+ to 4+) had sinusitis by the diagnostic criteria.

Table 5. Association between sinusitis and allergic rhinitis in asthmatic children

Asthmatic patients	With sinusitis	Without sinusitis	Total
With AR*	39	41	80
Without AR*	31	35	66
Total	70	76	146

*AR = Allergic rhinitis

There was no correlation between the occurrence of sinusitis and the severity of asthma ($p > 0.05$) (Table 4). A moderate degree of asthma was found in 33.6% and a severe degree was found in 66.4% of patients in this study. There was no significant difference in occurrence of sinusitis between the asthmatic children with and without allergic rhinitis ($p > 0.05$) (Table 5). There was also no significant difference between the duration of asthma in the children with and without sinusitis (37.7 ± 3.2 vs 30.9 ± 5.4 months,

$p > 0.05$) and no correlation between age and severity grade of sinusitis (correlation coefficient $R^2 = 0.05$).

DISCUSSION

Paranasal sinusitis has been diagnosed frequently in patients who have asthma. The occurrence of sinusitis has been found to be higher in asthmatic patients than in the normal population of the same age.^{7,8} Acute sinusitis usually occurs as a complication in approximately 0.5% of common colds so the incidence of sinusitis in children should be about 3-4% of the total population per year.^{7,9} The occurrence of sinusitis in asthmatic children has been reported to vary between 27%¹⁰ and 53%¹¹ depending on the population and criteria for radiographic diagnosis. If sinus mucosal thickening of 5 mm or more is used as the criterion for diagnosis of sinusitis, 40% of flare-up asthmatic patients are found to have sinusitis.¹² In our present study, 83.6% of Thai asthmatic children had abnormal sinus radiographs while 48% had radiologic diagnosis of sinusitis. This occurrence is very similar to the prevalence of sinusitis reported elsewhere.¹³ In this study, we included only asthmatic children that were older than 1 year because radiographs have limited utility in infants. A good correlation between radiographic abnormalities and the presence of clinical symptoms has been shown in children older than one year of age.¹⁴

Radiograph have been known to both under- and over-estimate the severity of sinus disease. Criteria for diagnosis of sinusitis by radiographs in previous studies have varied from more than 2 mm to more than 6 mm of sinus mucosal thickening. Mucosal thickening of more than 6 mm, air fluid level, or opacification of the sinus has been considered sinusitis with a sensitivity of 61-82%.¹⁵ The previous study that correlated signs and symptoms with microbiology

of sinus aspiration found that 70-75% of children with clinical and radiographic evidence of more than 5 mm of mucosal thickening had positive cultures from maxillary sinus aspiration.¹⁶ We therefore have accepted more than 5 mm of sinus mucosal thickening to be diagnostic for sinusitis in this study.

Previous studies have shown that maxillary sinusitis is the most common type involved and well visualized with occipitomeatal view. Ethmoidal sinusitis is often involved at the same time and visualized in the occipitomeatal view as well but if not, it should be visualized in the occipitofrontal view.^{15,17,18} In our study, both occipitomeatal and occipitofrontal views were obtained in each case and the maxillary sinus was the most commonly involved sinus. Frontal sinusitis is not as common in children as in adults because the average time of frontal sinus appearance in X-ray films is between 7 to 9 years of age.¹⁹

The most common signs and symptoms associated with bacterial sinusitis are cough, wheeze and nasal discharge.¹⁷ Unfortunately, these complaints are also found in asthmatic patients without obvious evidence of infection. In our study, we clinically diagnosed sinusitis only when the patients had signs and symptoms other than those found in asthma, so the number of patients with clinical diagnosis of sinusitis was smaller than expected.

We showed that the occurrence of sinusitis in children with asthma showed no correlation with the diagnosis of allergic rhinitis. It has been reported that patients with asthma have higher rates of sinusitis than those with allergic rhinitis.¹¹ This finding may be because allergic rhinitis usually is associated with sinus mucosal thickening of less than 4 mm²⁰ that does not reach the diagnostic criterion of sinusitis. A previous report showed that the occurrence of sinusitis had no corre-

lation with severity of asthma⁹ which was confirmed by our study.

One of the most important problems is whether to treat or not to treat asthmatic children with sinusitis judged by radiography. This subject is still controversial and needs more study. At this moment, we treat sinusitis in asthmatic children when the patients have definite signs and symptoms of sinusitis, or when the severity of asthma becomes worse with general asthmatic treatment.

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