ORIGINAL ARTICLE

Prevalence of allergic rhinitis and its associated morbidity in adults with asthma: a multicentre study

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Objectives To assess the prevalence of allergic rhinitis in adult patients with asthma in Hong Kong, and to compare the morbidity endured by asthma patients with and without allergic rhinitis.

Design Cross-sectional study.

Setting Respiratory clinics of four major public hospitals in Hong Kong.

Patients A total of 600 adults with asthma were recruited from March to May 2007.

Main outcome measures Doctors and patients completed separate questionnaires evaluating symptoms, treatment, and health care utilisation. Spirometry data were obtained for a subgroup of patients at the time of survey completion.

Results The patients consisted of 267 males and 333 females, with 251 having spirometry data. The mean pre-bronchodilator 1-second forced expiratory volume predicted among those who had spirometry performed was 88% (standard deviation, 28%). In all, 50% of the patients had intermittent and 50% had persistent asthma. Over three quarters (463/600; 77%) of patients had experienced allergic rhinitis symptoms in the past 12 months, of whom 96% had a previous diagnosis of allergic rhinitis. Asthmatics without allergic rhinitis symptoms had higher rates of visits to doctors, pharmacy visits, emergency department attendances, and hospitalisations for asthma than those with both conditions. Among subjects with asthma and allergic rhinitis, those taking nasal steroid (226/463; 49%) had lower rates of emergency department visits (13 vs 25%, P=0.002) and hospitalisations (7 vs 13%, P=0.045) for asthma than those who were not.

Conclusion Allergic rhinitis is a common co-morbid condition of asthma in this hospital clinic cohort. Treatment of allergic rhinitis with intra-nasal steroid was associated with less health care utilisation for asthma.

Key words
Asthma; Comorbidity; Rhinitis

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Introduction

Allergic rhinitis (AR) is a common co-morbid condition associated with asthma. It is defined as inflammation of the lining of the nose and is characterised by nasal symptoms including anterior and/or posterior rhinorrhoea, sneezing, nasal blockage, and/or itching of the nose. These symptoms occur during 2 or more consecutive days, mostly for more than 1 hour, and are unrelated to upper respiratory tract infections.[1] Asthma and AR are systemically linked by common and interrelated inflammatory processes of the upper and lower airways.[2-4] The nose and the lower airway is a continuous passage and the nose plays a homeostatic role by conditioning the inhaled air. Local allergic reactions can trigger systemic inflammation that affects both the upper and the lower airway.[3] A recent longitudinal study of 6461 subjects found that even in the absence of atopy, AR was a powerful predictor of adult-onset asthma.[5] However, another study involving 1321 subjects found that in AR patients referred to specialists, the features of AR, as described by the Allergic Rhinitis and its Impact on Asthma (ARIA) classification, did not predict the presence of asthma reliably.[6]

Previous studies showed that over 80% of the asthmatics have AR, whereas 10 to

40% of AR patients have concomitant asthma.[7] There are data suggesting that patients with asthma and AR endured increased morbidity and were more likely to use health care facilities than those with asthma alone.[8-10] In a 52-week multicentre study carried out in a western population, the presence of self-reported concomitant AR in patients with asthma was associated with a higher rate of asthma attacks and emergency room visits in comparison to those without AR.[8] Another study in the United Kingdom reported that adults with asthma and documented concomitant AR experienced more asthma-related general practitioner visits and hospitalisations, and incurred higher asthma drug cost than those having asthma alone.[9]

A recent survey explored the impact of AR co-morbidity in patients with asthma in four countries in the Asia-Pacific region (China, Singapore, South Korea, and Taiwan) and four countries in Europe (France, Germany, Italy, and United Kingdom).[11] The survey found that most patients (73%) had pre-existing symptoms of AR when their asthma was first diagnosed. Data from the Phase III International Study of Asthma and Allergies in Childhood (ISAAC) have shown that the prevalence of rhino-conjunctivitis among the 13–14-year-old subjects were 10% and 23% in China and Hong Kong, respectively.[12] In Hong Kong, between 1995 and 2001, the prevalence of AR among school children aged 6 to 7 years has been reported to have increased, whereas there was no significant change in asthma prevalence.[13] Limited information, however, is available concerning the prevalence of rhinitis among adults with asthma in Hong Kong.

This study aimed to assess the prevalence of rhinitis in adults with asthma in Hong Kong. In addition, we assess whether patients with asthma having concomitant AR endure higher morbidity than asthma patients without AR.

成人哮喘患者的過敏性鼻炎現患率和相關病症：多中心研究

目的 評估香港成人哮喘患者的過敏性鼻炎現患率，並將其並存病症與沒有患過敏性鼻炎的成人哮喘患者作比較。

設計 橫斷面研究。

安排 香港四家主要公立醫院的呼吸系統診所。

患者 2007年3月至5月期間招募的600名成人哮喘患者。

主要結果測量 醫生和患者分別完成評估症狀、治療和醫療保健運用的問卷調查，及後收集部分患者的肺活量計數據。

結果 267名男性和333名女性患者中，收集其中251名的肺活量計數據。使用肺活量計的患者其支氣管擴張劑使用前的一秒內用力呼氣量的中位數是88%（標準差，28%）。總括而言，50%患有間歇性哮喘，50%則有持續性哮喘。超過四分之三（463/600；77%）的患者在過去12個月曾出現過敏性鼻炎症狀，當中96%曾確診過敏性鼻炎。沒有過敏性鼻炎症狀的哮喘患者無論因哮喘而求診、往藥房配藥、看急症和入院的頻率都較有過敏性鼻炎症狀的哮喘患者為高。同時有過敏性鼻炎症狀和哮喘的患者，使用鼻類固醇（226/463；49%）的看急症（13比25%，P=0.002）和入院（7比13%，P=0.045）頻率也較沒有使用者為低。

結論 根據上述患者組別的數據結果，過敏性鼻炎是哮喘的併發病症。利用鼻腔用類固醇治療過敏性鼻炎，有助減輕與哮喘有關的醫療保健服務負擔。

Methods

This was a cross-sectional study involving the respiratory clinics of four major public hospitals in Hong Kong (the Pamela Youde Nethersole Eastern Hospital [PYNEH], the Prince of Wales Hospital [PWH], the Queen Mary Hospital [QMH], and the United Christian Hospital [UCH]). Subjects aged 18 to 80 years were recruited from March to May in 2007. All subjects had a diagnosis of asthma for at least 1 year based on symptoms (wheeze, shortness of breath, cough, or chest tightness), together with lung function measurements showing significant reversibility to bronchodilator (increase of ≥12% [and 200 mL] in 1-second forced expiratory volume after 400 μg albuterol delivered by a metered dose inhaler with a spacer). The PWH and UCH each recruited 200 consecutive patients from their clinics, whereas the QMH and PYNEH recruited 100 consecutive subjects each. All the subjects at PWH had pre- and post-bronchodilator spirometry, while the first 40 and 20 subjects at QMH and UCH, respectively had spirometry performed on the day of the questionnaire survey. Patients were asked not to use any β-agonist for 6 hours prior to visiting to the clinic. Spirometry pre- and post-bronchodilator (after 400 mg albuterol given by metered dose inhaler with spacer) was performed according to the American Thoracic Society (ATS) and European Thoracic Society (ERS) standards[14,15] using the Vitalograph (Buckingham, UK) spirometer. The updated predicted spirometry values for Hong Kong Chinese subjects were adopted.[16] Subjects with a history of chronic obstructive lung disease, bronchiectasis, or lung resection were excluded from this study.

Both the doctor and the patient were asked to fill in separate questionnaires. The questionnaires were derived from well-validated questionnaires from the ISAAC.[17] The 'doctor' questionnaire contained items on demographics of the subjects, their smoking history, age of onset of asthma, asthma severity evaluation (according to the Global Initiative of Asthma [GINA] 2005 guideline[18]) with day and night symptoms, use of rescue bronchodilator, and lung

function (spirometry or peak expiratory flow rate if available), and questions on AR (using the severity classification according to the ARIA guideline[7]). The subjects would be regarded as positive for AR if they had any symptoms such as sneezing, or runny, blocked or itchy nose within the last 12 months unrelated to upper respiratory infection. The AR subjects were diagnosed with intermittent or persistent types based on the self-reported duration of symptoms. Intermittent AR was defined as a report of nasal symptoms lasting less than 4 days/week or less than 4 weeks in the past 12 months. Persistent AR was defined as nasal symptoms lasting more than 4 days/week and more than 4 weeks in the past 12 months.[7] The drug treatment for both asthma and AR was also recorded by the doctor. Concerning the questionnaire to patients, it contained information on the health care utilisation by the patient in the previous 12 months for asthma and for AR. The study was approved by the respective ethics committees of the four hospitals involved.

Data were analysed by the Statistical Package for the Social Sciences (Windows version 13.0; SPSS Inc, Chicago [IL], US). Results were expressed as proportions or means and standard deviations (SDs). The *t* test was used for comparisons of continuous data and the χ^2 test for discrete data. These were applied to the analysis of baseline characteristics, health care utilisation of the asthma subjects with or without AR, and the morbidity of the patients with AR on different kinds of treatment for the AR. Multiple logistic regression analysis was used to assess the health care utilisation patterns of patients with asthma and AR in comparison to those of subjects with asthma but without AR, with adjustment of the age, smoking history, and asthma severity. The

TABLE 1. Demographic data of the asthma subjects

Demographics*	Data†			P value‡
	All subjects (n=600)	Subjects with AR symptoms (n=463)	Subjects without AR symptoms (n=137)	
Age (years)	47 ± 15	44 ± 15	56 ± 14	<0.001
Sex				0.07
Male	267 (45)	197 (43)	70 (51)	
Female	333 (56)	266 (57)	67 (49)	
Body mass index (kg/m^2)	24 ± 5	24 ± 5	25 ± 6	0.098
Age of onset of asthma (years)	25 ± 19	22 ± 18	35 ± 20	<0001
Duration of asthma (years)	23 ± 15	23 ± 15	22 ± 17	0.20
Smoking				0.03
Never smoker	455 (76)	362 (78)	93 (68)	
Past smoker	106 (18)	72 (16)	34 (25)	
Current smoker	39 (7)	29 (6)	10 (7)	
Asthma severity by GINA guideline				
Intermittent	297 (50)	241 (52)	56 (41)	0.02
Mild/moderate/severe persistent	303 (51)	222 (48)	81 (59)	
Lung function test (sub-group of n=251)		(n=204)	(n=47)	
Pre-bronchodilator FEV_1 predicted (%)	88 ± 28	88 ± 20	86 ± 51	0.76
Post-bronchodilator FEV_1 predicted (%)	95 ± 23	95 ± 18	94 ± 36	0.80
Asthma treatments				
As-needed bronchodilator only	9 (2)	8 (2)	2 (1)	0.75
ICS (with and without LABA)	581 (97)	448 (97)	133 (97)	0.85
ICS with LABA	362 (60)	267 (58)	95 (69)	0.01
Theophylline	120 (20)	84 (18)	36 (26)	0.04
Leukotriene modifier	66 (11)	49 (11)	17 (12)	0.55
Long-acting oral β_2 agonist	21 (4)	13 (3)	8 (6)	0.09
Oral steroid	21 (4)	12 (3)	9 (7)	0.03

* AR denotes allergic rhinitis, FEV_1 1-second forced expiratory volume, GINA Global Initiative of Asthma, ICS inhaled corticosteroid, and LABA inhaled long-acting β_2 agonist

† Data are presented as No. (%) or mean ± standard deviation; because of rounding, not all percentages total 100

‡ Comparison between the asthma subjects with and without AR symptoms

results were presented as odds ratios (ORs) and 95% confidence intervals (CIs). P values of less than 0.05 were considered statistically significant.

Results

This study recruited 600 subjects (267 males, 45%), whose demographic data are shown in Table 1. Pre- and post-bronchodilator spirometry was performed in a subgroup (n=251, 42%) from the PWH (n=194), QMH (n=39) and UCH (n=18) on the same day of the questionnaire survey. Among these patients, 6, 1, and 2 respectively were unable to perform reproducible spirometry according to the ATS/ERS standard.[14,15] Patients who had spirometry assessment did not differ from those not undergoing such assessment with respect to age, gender, asthma severity, and asthma medications prescribed (including inhaled steroids, inhaled long-acting β_2 agonists, and leukotriene modifiers). However, the percentage with AR (81% vs 74%; P=0.04) and percentage of never smokers (84% vs 70%; P<0.001) among those undergoing spirometry was higher (Table 2). For current and ex-smokers, the median (interquartile range) pack-years of smoking were 10 (4-20) and 7 (1.5-20), respectively.

All the patients had a clinical diagnosis of asthma based on the GINA 2005 guideline[18] that classified the subjects into intermittent, mild/moderate/severe persistent asthma according to their symptoms and lung function results (if available). Among the subjects, 50% and 13%/24%/15% had intermittent and mild/moderate/severe persistent asthma, respectively. Overall, 463 (77%) of the subjects had AR symptoms (sneezing or runny or blocked nose when not having a cold or flu) in the past 12 months and among these, 445 (96%) had a previous diagnosis of AR. The mean (SD) duration of the diagnosis of AR was 23 (18) years; in 149 (32%) AR was seasonal and in 314 (68%) it was perennial rhinitis with seasonal exacerbations. The rates of the different severities of the AR symptoms according to the ARIA guideline[7] and the treatment they received are shown in Table 3. More subjects had intermittent AR (62%) than persistent AR (38%). Among subjects with persistent AR symptoms, more than 50% were in receipt of nasal glucocorticosteroid, and less than 5% were taking a leukotriene modifier.

Health care utilisation data pertaining to these asthmatic patients with and without AR symptoms are shown in the Figure. Asthmatics without AR had higher rates of unscheduled visits to doctors, pharmacies, and emergency departments as well as hospitalisation for asthma symptoms than those with AR symptoms. Subjects with both asthma and AR symptoms were more likely than the rest to visit doctors and pharmacy stores and take sick leave for nasal symptoms. In subjects with asthma and AR

TABLE 2. Comparison of the demographics of subjects with and without spirometry results

Demographics*	Data†		P value
	With spirometry (n=251)	Without spirometry (n=349)	
Age (years)	46 ± 14	47 ± 17	0.68
Sex			0.15
Male	103 (41)	164 (47)	
Female	148 (59)	185 (53)	
Symptoms of AR	204 (81)	259 (74)	0.04
Smoking			
Never smoker	212 (84)	243 (70)	<0.001
Past smoker	29 (12)	77 (22)	
Current smoker	10 (4)	29 (8)	
Asthma severity by GINA guideline			
Intermittent	136 (54)	161 (46)	0.05
Persistent	115 (46)	188 (54)	
Asthma medications			
ICS with or without LABA	242 (96)	339 (97)	0.62
ICS + LABA	153 (61)	209 (60)	0.79
Leukotriene modifier	25 (10)	41 (12)	0.49

* AR denotes allergic rhinitis, GINA Global Initiative of Asthma, ICS inhaled corticosteroid, and LABA inhaled long-acting β_2 agonist

† Data are presented as No. (%) or mean ± standard deviation

TABLE 3. Treatment of the different severities of allergic rhinitis (AR)*

Treatment of AR	AR severity according to the ARIA guideline,[7] No. (%)				All subjects with AR (n=463), No. (%)
	Intermittent mild (n=237)	Intermittent moderate-severe (n=51)	Persistent mild (n=91)	Persistent moderate-severe (n=84)	
Oral H_1 blocker	50 (21)	13 (25)	29 (32)	44 (52)	136 (29)
Nasal H_1 blocker	0	0	0	0	0
Oral decongestant	6 (3)	1 (2)	2 (2)	1 (1)	10 (2)
Nasal decongestant	0	0	1 (1)	1 (1)	2 (0.4)
Leukotriene modifier	6 (3)	1 (2)	1 (1)	3 (4)	11 (2)
Nasal glucocorticosteroid	100 (42)	21 (41)	49 (54)	56 (67)	226 (49)

* ARIA denotes Allergic Rhinitis and its Impact on Asthma, and H_1 histamine

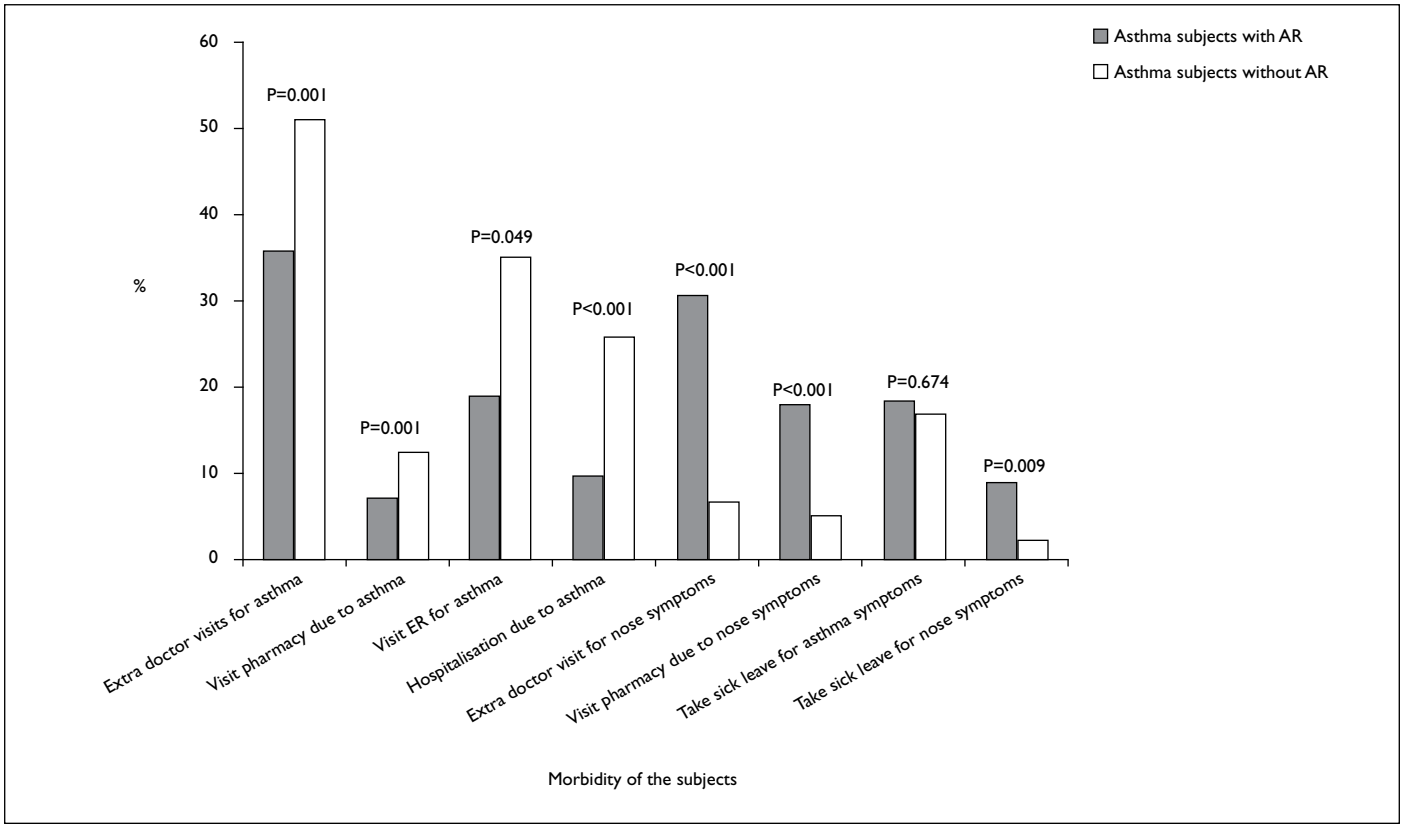

FIG. Morbidity of the asthma subjects with and without allergic rhinitis symptoms
AR denotes allergic rhinitis and ER emergency room; P value comparing the asthma subjects with AR and those without AR

symptoms, those on nasal steroids had lower rates of visits to emergency departments (13% vs 24%; P=0.002) and hospitalisation (7% vs 13%; P=0.045) for asthma compared with those not using nasal steroids. The relationship between the treatment for AR and the health care utilisation in patients with both asthma and AR is shown in Table 4.

Multiple logistic regression showed that after adjustment for age, smoking, and asthma severity, those with asthma and AR had lower likelihood of unscheduled visits to doctors for asthma symptoms (OR=0.62; 95% CI, 0.41-0.96; P=0.030) and a higher likelihood of visiting pharmacies for nasal symptoms (OR=3.47; 95% CI, 1.48-8.12; P=0.004) than subjects with asthma without AR (Table 5). There were no differences between the two groups in terms of visits to pharmacies for asthma symptoms, visits to emergency departments, hospitalisation for asthma, and the taking of sick leave for asthma and nasal symptoms.

Discussion

In this multicentre clinic cohort of asthma patients

TABLE 4. Morbidity of patients with asthma and rhinitis stratified by the treatment of rhinitis

Morbidity	No. (%)					
	On oral anti-histamine			On nasal glucocorticosteroid		
	Yes (n=136)	No (n=327)	P value	Yes (n=226)	No (n=237)	P value
Extra doctor visit due to asthma symptoms	66 (49)	100 (31)	<0.001	74 (33)	92 (39)	0.173
Visit pharmacy due to asthma symptoms	10 (7)	23 (7)	0.90	14 (6)	19 (8)	0.446
Visit emergency room due to asthma symptoms	34 (25)	54 (17)	0.03	30 (13)	58 (24)	0.002
Hospitalisation due to asthma	14 (10)	32 (10)	0.87	16 (7)	30 (13)	0.045
Visit pharmacy due to nose symptoms	25 (18)	59 (18)	0.93	42 (19)	42 (18)	0.810
Take any sick leave for asthma symptoms	27 (20)	58 (18)	0.59	39 (17)	46 (19)	0.550
Take any sick leave for nose symptoms	14 (10)	27 (8)	0.48	27 (12)	14 (6)	0.022

TABLE 5. Logistic regression analysis for morbidity of subjects with asthma and rhinitis compared with asthma alone (subjects with asthma and AR are taken as the reference in the logistic regression model)

Morbidity	Crude odds ratio (95% confidence interval)	Crude P value	Adjusted odds ratio (95% confidence interval)*	Adjusted P value
Extra doctor visit due to asthma symptoms	0.54 (0.36-0.79)	0.001	0.62 (0.41-0.96)	0.030
Visit pharmacy due to asthma symptoms	0.54 (0.29-1.01)	0.052	0.52 (0.26-1.03)	0.060
Visit emergency room due to asthma symptoms	0.44 (0.29-0.66)	<0.001	0.78 (0.39-1.55)	0.477
Hospitalisation due to asthma	0.32 (0.20-0.53)	<0.001	0.88 (0.41-1.89)	0.745
Visit pharmacy due to nose symptoms	4.12 (1.86-9.13)	<0.001	3.47 (1.48-8.12)	0.004
Take any sick leave for asthma symptoms	1.12 (0.67-1.85)	0.067	0.57 (0.30-1.08)	0.082
Take any sick leave for nose symptoms	4.34 (1.32-14.24)	0.015	2.46 (0.68-8.90)	0.169

* Logistic model with adjustment of age, smoking, and asthma severity

in Hong Kong, AR was a very common co-morbid illness, as shown by the fact that 77% of them had symptoms of AR in the previous 12 months and among these, 96% had a previous diagnosis of AR. Interestingly, patients with asthma and concomitant AR tended to be younger, had more intermittent than persistent asthma compared with asthmatics without AR. In patients with asthma and concomitant AR, nasal steroid treatment was associated with lower rates of visits to emergency departments and hospitalisation for asthma symptoms.

Previous studies suggested that AR was frequently underdiagnosed. In a study with investigator-confirmed AR, 45% of patients had not reported a previous diagnosis by physicians.[19] Most individuals with AR self-medicate using over-the-counter antihistamines however.[20] Available data on the prevalence of AR among Chinese adult are limited. A recent study found that the self-reported prevalence of AR in 11 cities across mainland China had wide variations, ranging from less than 10% to more than 20%.[21] Another study from rural China involving 10 009 asthmatic subjects reported a prevalence rate of 6.2%.[22] In our cohort, we observed that over 95% of the subjects with AR symptoms in the past 12 months had a diagnosis of AR. A hospital-based study as opposed to a community study could explain this variation. Physicians working in respiratory clinics are more likely to explore nasal symptoms when managing their asthma patients than general practitioners who look after patients with a wide variety of medical problems. Even though the majority of patients had physician-diagnosed AR among those with AR symptoms, only about 50% and 30% were treated with nasal steroids and oral anti-histamine therapy, respectively (even fewer took a leukotriene modifier). These findings suggest under-treatment of the condition.

Most previous studies have suggested that AR increases the morbidity of asthma.[8-10] One reported that adult asthmatics with concomitant AR consumed more asthma-related health care resources, in terms of general practitioner visits, hospitalisations, and prescription medication costs than did patients with asthma alone. Such results were consistent across different levels of asthma severity as assessed indirectly by analyses based on the intensity of asthma drug use.[9] A similar pattern of health resources use was observed in children in a companion study based on the same general practice database.[23] Another study found that presence of self-reported concomitant AR in patients with asthma resulted in higher rates of asthma attacks and more emergency room visits, but not on hospitalisations and unscheduled visits to doctors, compared with asthmatics with no AR, despite having milder and slightly better controlled asthma at baseline.[8] However, the enhanced effect of concomitant AR on the morbidity of asthma was not observed in the current study on adults. A previous study found that asthma severity among atopic subjects was less in persons with nasal symptoms than those without, whereas in non-atopic asthmatics the converse was true.[24] As tests for atopy were not performed in the current study, we are not sure if atopic status might explain the milder asthma in our cohort with AR. After adjustment for age, smoking and asthma severity, patients with asthma and AR nevertheless had a lower rate of extra visits to doctors for asthma symptoms than those with asthma alone (Table 5). This suggests that the above-mentioned factors could not be the sole factors responsible for the higher morbidity in the asthma patients without concomitant AR.

In the current study, about half of the subjects were treated with nasal steroids. Among patients with both AR and asthma, treatment of AR with nasal steroids was associated with fewer emergency department visits and hospitalisations for asthma than in those not using nasal steroids. There is presently a paucity of evidence to suggest that treating co-morbid AR confers better asthma-related outcomes in addition to any obvious benefits with regard to AR symptoms.[4] Data as to whether intranasal steroids decrease bronchial hyperresponsiveness in lower airways are conflicting.[25,26] One study showed

that they did not improve asthma symptoms, but bronchial responsiveness were not measured.[27] A retrospective cohort study involving almost 5000 American patients aged 12 to 60 years with co-morbid asthma and AR reported that in those receiving treatment for AR, three quarters experienced about half as many asthma-related events (hospitalisation or emergency department visits) than those not receiving such therapy.[28] Similarly, in an Australian-managed care population of 14 000 asthmatic patients aged 5 years or older, treatment of AR with intranasal corticosteroids substantially reduced the risk of emergency department visits for asthma.[29] A nested case-control study on a United States–managed care population found that in patients aged 6 years or older with concomitant asthma and AR, treatment with nasal corticosteroids or second-generation anti-histamines was associated with a lower risk of asthma-related emergency room treatments and hospitalisations.[30] Treatment of AR with intranasal steroids was associated with less health care utilisation for asthma in the current study subjects. Further studies are nevertheless needed to assess whether intranasal steroids decrease the morbidity from asthma in patients who also have AR.

It appears that subjects with asthma and concomitant AR who took anti-histamine had higher rates of additional doctor and emergency room visits for asthma. Whether poorly controlled AR symptoms, with its associated need for more symptomatic relief from anti-histamine, leads to more asthma symptoms and thus asthma-related health care utilisation among our patients is uncertain. As only a few subjects in our study were treated with a leukotriene modifier (<5%), it was not possible to assess its role in influencing asthma outcomes. In the post-hoc analysis of a randomised controlled trial comparing the addition of montelukast against doubling the dose of inhaled corticosteroid (ICS) for 12 weeks in subjects whose asthma was uncontrolled on the standard doses,[31] for asthma patients with co-morbid AR, those prescribed montelukast enjoyed better lung function than those treated with doubled doses of ICS.[32] This finding implies an additional benefit to asthma control from a systemic agent that is able to treat both AR and asthma.[32] Previous studies suggested patients rated their AR disease as more severe than their physicians.[33] Conceivably, under-treatment of AR could be due to under-estimation of AR disease severity by physicians.[4] Presence of AR was also found to be associated with poor quality of life.[34,35] Studies to assess whether our asthmatic subjects might demand less health care utilisation and enjoyed improved quality of life upon treatment of their rhinitis (eg with intranasal steroid, leukotriene modifier, anti-histamines) would be of interest.

The merit of the current study was that it entailed a cross-sectional survey completed by both patients and physicians, in contrast to previous studies using large health care databases.[9,10,23] In addition, a subgroup of subjects in this study underwent lung function assessment, whereas most of the previous studies using databases omitted spirometry. The limitations of this study included its relatively small sample size and atopic status not being tested (by skin test or specific immunoglobulin E level determinations). In addition, the asthma classification used in the current study was based on 'severity' not 'control' as suggested in the latest GINA guideline.[36] Furthermore, drug compliance of the subjects was not assessed. Our patients probably had more severe asthma than those in the general population as they were being followed up at tertiary medical centres. Thus, the observations from this study might not be applicable to the broad population of asthma subjects in the community.

In conclusion, AR is a very common co-morbid condition associated with asthma in this hospital clinic cohort. Further studies to determine what treatment options can offer benefits to patients with asthma and concomitant AR are warranted.

Declaration

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References

1. International Consensus Report on the diagnosis and management of rhinitis. International Rhinitis Management Working Group. Allergy 1994;49(19 Suppl):1S-34S.
2. Bousquet J, Khaltaev N, Cruz AA, et al. Allergic Rhinitis and its Impact on Asthma (ARIA) 2008 update (in collaboration with the World Health Organization, GA(2)LEN and AllerGen). Allergy 2008;63 Suppl 86:8S-160S.
3. Togias A. Rhinitis and asthma: evidence for respiratory system integration. J Allergy Clin Immunol 2003;111:1171-83; quiz 1184.
4. Thomas M. Allergic rhinitis: evidence for impact on asthma. BMC Pulm Med 2006;6 Suppl 1:S4.
5. Shaaban R, Zureik M, Soussan D, et al. Rhinitis and onset of asthma: a longitudinal population-based study. Lancet 2008;372:1049-57.
6. Antonicelli L, Micucci C, Voltolini S, et al. Allergic rhinitis and asthma comorbidity: ARIA classification of rhinitis does not correlate with the prevalence of asthma. Clin Exp Allergy 2007;37:954-60.
7. Bousquet J, Van Cauwenberge P, Khaltaev N; Aria Working

Group; World Health Organization. Allergic rhinitis and its impact on asthma. J Allergy Clin Immunol 2001;108(5 Suppl):S147-334.
8. Bousquet J, Gaugris S, Kocevar VS, et al. Increased risk of asthma attacks and emergency visits among asthma patients with allergic rhinitis: a subgroup analysis of the investigation of montelukast as a partner agent for complementary therapy [corrected]. Clin Exp Allergy 2005;35:723-7.
9. Price D, Zhang Q, Kocevar VS, Yin DD, Thomas M. Effect of a concomitant diagnosis of allergic rhinitis on asthma-related health care use by adults. Clin Exp Allergy 2005;35:282-7.
10. Gaugris S, Sazonov-Kocevar V, Thomas M. Burden of concomitant allergic rhinitis in adults with asthma. J Asthma 2006;43:1-7.
11. Valovirta E, Pawankar R. Survey on the impact of comorbid allergic rhinitis in patients with asthma. BMC Pulm Med 2006;6 Suppl 1:S3.
12. Asher MI, Montefort S, Björkstén B, et al. Worldwide time trends in the prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and eczema in childhood: ISAAC Phases One and Three repeat multicountry cross-sectional surveys. Lancet 2006;368:733-43.
13. Lee SL, Wong W, Lau YL. Increasing prevalence of allergic rhinitis but not asthma among children in Hong Kong from 1995 to 2001 (Phase 3 International Study of Asthma and Allergies in Childhood). Pediatr Allergy Immunol 2004;15:72-8.
14. Standardization of Spirometry, 1994 Update. American Thoracic Society. Am J Respir Crit Care Med 1995;152:1107-36.
15. Miller MR, Hankinson J, Brusasco V, et al. Standardisation of spirometry. Eur Respir J 2005;26:319-38.
16. Ip MS, Ko FW, Lau AC, et al. Updated spirometric reference values for adult Chinese in Hong Kong and implications on clinical utilization. Chest 2006;129:384-92.
17. Asher MI, Keil U, Anderson HR, et al. International Study of Asthma and Allergies in Childhood (ISAAC): rationale and methods. Eur Respir J 1995;8:483-91.
18. National Heart. Lung and Blood Institute, World Health Organization. Global strategy for asthma management and prevention. 2005 update. 2005; NIH Publication No 02-3659: http://www.ginasthma.com/GuidelineList.asp?l1=2&l2=1. Accessed 1 Nov 2006.
19. Bauchau V, Durham SR. Prevalence and rate of diagnosis of allergic rhinitis in Europe. Eur Respir J 2004;24:758-64.
20. Stang P, Meltzer E, Derebery J, Nathan R, Campbell U, Stanford R. Infrequent treatment of symptoms among rhinitis symptom sufferers during an allergy season. J Allergy Clin Immunol 2006;117(Suppl):322S.
21. Zhang L, Han D, Huang D, et al. Prevalence of self-reported allergic rhinitis in eleven major cities in China. Int Arch Allergy Immunol 2008;149:47-57.
22. Celedón JC, Palmer LJ, Weiss ST, Wang B, Fang Z, Xu X. Asthma, rhinitis, and skin test reactivity to aeroallergens in families of asthmatic subjects in Anqing, China. Am J Respir Crit Care Med 2001;163:1108-12.
23. Thomas M, Kocevar VS, Zhang Q, Yin DD, Price D. Asthma-related health care resource use among asthmatic children with and without concomitant allergic rhinitis. Pediatrics 2005;115:129-34.
24. Kanani AS, Broder I, Greene JM, Tarlo SM. Correlation between nasal symptoms and asthma severity in patients with atopic and nonatopic asthma. Ann Allergy Asthma Immunol 2005;94:341-7.
25. Dahl R, Nielsen LP, Kips J, et al. Intranasal and inhaled fluticasone propionate for pollen-induced rhinitis and asthma. Allergy 2005;60:875-81.
26. Foresi A, Pelucchi A, Gherson G, Mastropasqua B, Chiapparino A, Testi R. Once daily intranasal fluticasone propionate (200 micrograms) reduces nasal symptoms and inflammation but also attenuates the increase in bronchial responsiveness during the pollen season in allergic rhinitis. J Allergy Clin Immunol 1996;98:274-82.
27. Nathan RA, Yancey SW, Waitkus-Edwards K, et al. Fluticasone propionate nasal spray is superior to montelukast for allergic rhinitis while neither affects overall asthma control. Chest 2005;128:1910-20.
28. Crystal-Peters J, Neslusan C, Crown WH, Torres A. Treating allergic rhinitis in patients with comorbid asthma: the risk of asthma-related hospitalizations and emergency department visits. J Allergy Clin Immunol 2002;109:57-62.
29. Adams RJ, Fuhlbrigge AL, Finkelstein JA, Weiss ST. Intranasal steroids and the risk of emergency department visits for asthma. J Allergy Clin Immunol 2002;109:636-42.
30. Corren J, Manning BE, Thompson SF, Hennessy S, Strom BL. Rhinitis therapy and the prevention of hospital care for asthma: a case-control study. J Allergy Clin Immunol 2004;113:415-9.
31. Price DB, Hernandez D, Magyar P, et al. Randomised controlled trial of montelukast plus inhaled budesonide versus double dose inhaled budesonide in adult patients with asthma. Thorax 2003;58:211-6.
32. Price DB, Swern A, Tozzi CA, Philip G, Polos P. Effect of montelukast on lung function in asthma patients with allergic rhinitis: analysis from the COMPACT trial. Allergy 2006;61:737-42.
33. Scadding GK, Bousquet J. A survey of the burden of allergic rhinitis in the USA. (Introduction). Allergy 2007;62 Suppl 85:3S-5S.
34. Schatz M. A survey of the burden of allergic rhinitis in the USA. Allergy 2007;62 Suppl 85:9S-16S.
35. Canonica GW, Bousquet J, Mullol J, Scadding GK, Virchow JC. A survey of the burden of allergic rhinitis in Europe. Allergy 2007;62 Suppl 85:17S-25S.
36. National Heart, Lung and Blood Institute, World Health Organization. Global Strategy for asthma management and prevention. 2010 Update. 2010;NIH Publication No 02-3659: http://www.ginasthma.com/GuidelinesResources.asp?l1=2&l2=0. Accessed 3 May 2010.