Prim Care Respir J 2012; 21(2): 222-228

Primary Care RESPIRATORY JOURNAL
www.thepcrj.org

CASE-BASED LEARNING

Poor asthma control? – then look up the nose. The importance of co-morbid rhinitis in patients with asthma

***Glenis Scadding[a], Samantha Walker[b]**

[a] The Royal National Throat, Nose and Ear Hospital, London, UK
[b] Asthma UK, London, UK

Originally received 2nd April 2011; resubmitted 7th February 2012; accepted 22nd February 2012; online 29th May 2012

Summary

Many factors can impair asthma control. One which is frequently overlooked is rhinitis. Asthma patients with significant rhinitis are over four times more likely to have poorly controlled asthma than those without. Over 80% of patients with asthma have rhinitis, which may be allergic or inflammatory/non-allergic. Both types of rhinitis share pathophysiological similarities with eosinophilic asthma, cause bronchial hyper-reactivity, and are predisposing factors for the subsequent development of asthma. Nasal allergen challenge in allergic rhinitis results in inflammation in the bronchi as well as the nose, and the reverse is also true. This article reviews briefly the evidence for the link between asthma and rhinitis, advocates looking for rhinitis when patients present with poorly controlled asthma, and provides guidance for the diagnosis and treatment of rhinitis.

© 2012 Primary Care Respiratory Society UK. All rights reserved.
G Scadding and S Walker. *Prim Care Respir J* 2012; **21**(2): 222-228
http://dx.doi.org/10.4104/pcrj.2012.00035

Keywords rhinitis, asthma, co-morbidity, diagnosis, treatment, airway inflammation

Clinical scenario

A young woman has just moved into the area and has registered as a patient at your primary care practice. Two weeks later she attends your asthma clinic complaining that she is bothered by intermittent coughing at night and by chest tightness and wheezing if she has to hurry. She has to use her reliever salbutamol inhaler at least twice a day. She is a non-smoker and insists that she is using her inhaled corticosteroid (ICS) plus long-acting β2-agonist (LABA) inhaler regularly as directed. She is on no other medication and has had no recent change in her circumstances. Her inhaler technique is good. She has a family history of hay fever, and admits to occasional sneezing in the summer months.

One possibility is that she has concomitant rhinitis – like 80% of patients with asthma – and that this is presently untreated. On taking a history it becomes clear that rhinitis has not previously been considered and that she has not undergone examination or clinical tests to establish a diagnosis.

(Fictional clinical case; no signed consent form required)

Introduction: the difference between asthma severity and asthma control

National and international asthma treatment guidelines have previously focused on the assessment and classification of the severity of symptoms.[1-4] Evidence now suggests that asthma severity is a variable feature of a patient's condition and may fluctuate over months or years,[5,6] possibly leading to underestimation of severity, inadequate therapy and increased morbidity. Findings from studies of discordance between asthma severity and symptoms/lung function, and between severity, inhaled corticosteroid (ICS) and reliever medication use,[7] suggest that classification and treatment of asthma based on severity alone is inappropriate.

In view of these considerations, and the demonstration in several studies that asthma control was achievable in most patients,[8-13] the Global Initiative for Asthma (GINA) guidelines currently recommend treatment based on achieving and maintaining asthma control.[1] This is defined as "the extent to which the manifestations of asthma have been reduced or removed by treatment" based on assessment of the dual

* Corresponding author: Dr Glenis Scadding, The Royal National Throat, Nose and Ear Hospital, Gray's Inn Road, London, UK.
Tel: +44 (0)207 9151542 Fax: +44 (0)207 9151674 E-mail: g.scadding@ucl.ac.uk

components of current clinical control (e.g. symptoms, limitation of activities/ quality of life (QoL), reliever/rescue treatment use, and lung function) as well as future risk (e.g. exacerbations, decline in lung function, and side effects of treatment).[14,15]

The role of rhinitis in poor asthma control

Although guideline-defined asthma control is achievable in the majority of patients under strict clinical trial conditions, in real life many patients with asthma continue to have symptoms and poor asthma control.[1,16] The major reasons for this are summarised in Table 1.[17,18] It is beyond the scope of this article to discuss in detail the evidence for each factor associated with inadequate asthma control. However, rhinitis is a common co-morbidity in many patients with asthma, and the role of uncontrolled rhinitis as a major contributory factor for poor asthma control has recently been highlighted in several studies.[19-21] A survey in UK general practice recently showed that asthma patients with significant rhinitis were 4-5 times more likely to have poorly controlled asthma compared to patients without rhinitis, with an odds ratio greater than that for poor compliance with asthma therapy.[19] Similarly, a survey of asthma outpatients indicated that chronic rhinitis was the most important risk factor associated with emergency room visits due to asthma exacerbations.[20]

Making the diagnosis of rhinitis

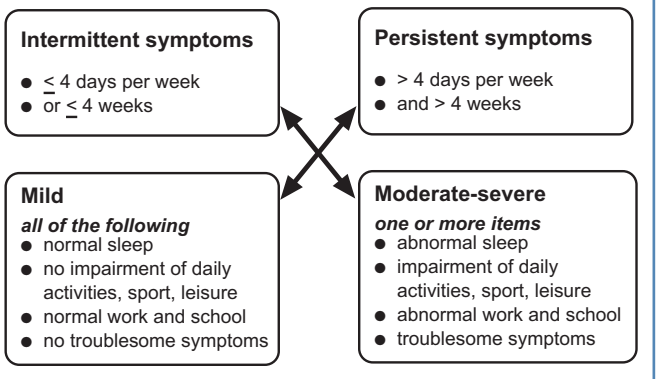
The cardinal symptoms of rhinitis are rhinorrhoea (nasal discharge), nasal obstruction, itching and sneezing. The diagnosis of rhinitis can be confirmed by following a few simple steps.[22] Useful diagnostic questionnaires are available at www.whiar.org.[23]

- **Taking a specific history**. Rhinitis can broadly be divided into three categories; allergic, infective and non-allergic.
  - Sneezing, itchy nose and palate are likely signs of allergic rhinitis (AR).
  - Ask if the symptoms are intermittent or persistent according to the evidence-based World Health Organization (WHO)-sponsored Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines;[23] (see Figure 1 for guidance to subsequent tests and treatment).
  - Rhinorrhoea can be due to allergen, viral/bacterial infections, alcohol, medications, malignancies, etc. Rarely, isolated rhinorrhoea can be a CSF leak.
  - Nasal obstruction/blockage in alternating nostrils is a normal manifestation of rhinitis; bilateral blockage can occur with severe rhinitis, but is more common with nasal polyps.
  - Unilateral symptoms are unlikely to be due to allergy, and referral to an ENT surgeon is wise.
  - Bilateral itchy, red, swollen eyes are usually associated with AR.
- **Taking a family and social history**. A family history of any allergic disease (e.g. summer hay fever) makes a diagnosis of AR and asthma more likely. Symptoms on exposure to relevant triggers such as pets, mould, occupational allergens, etc. gives further indication of the probable cause of rhinitis.
- **Physical examination**. Observe the patient for reduced nasal airflow, mouth breathing, a horizontal nasal crease across the dorsum of the nose, and differences in contour of the nasal bridge. Examine for polyps, crusting, a perforated septum, or mucosal congestion, all of which can indicate persistent rhinitis.
- **Routine tests**. Blood tests help to exclude other conditions as well as confirm some causes of rhinitis (e.g. thyroid function tests for nasal obstruction). Skin prick tests or serum specific

Table 1. Reasons for continuing symptoms and poor asthma control

Category
Clinical factors
• Co-morbidity (e.g. rhinitis, COPD, obstructive bronchiolitis, bronchiectasis, tracheobronchomalacia, recurrent aspiration, congestive heart failure, etc)
• Triggers (e.g. house dust mite, pets, occupational, exercise, drug, passive smoking, new allergens)
• Genetic
• Asthma type (e.g. aspirin-sensitivity, neutrophilic activity, severe therapy-resistant)
Patient behavioural-related factors
• Low/non adherence with therapy
• Incorrect use of inhaler leading to ineffective/reduced drug delivery
• Smoking interfering with steroid treatment
• Low patient expectations/aspirations/goals of therapy
• Unwillingness to use therapy and/or attend medical consultations
• Reliance on complimentary/alternative therapies
Physician/healthcare-related factors
• Inadequate assessment and treatment
• Misdiagnosis
• Inadequate use of action plans
• Low physician expectations

Figure 1. ARIA classification of allergic rhinitis



Adapted from http://www.whiar.org (full permission obtained)

Table 2. Evidence for a link between rhinitis and asthma

Evidence	Reference
Epidemiological	
Approximately 20-60% of patients with allergic rhinitis have clinical asthma, whereas >80% of patients with allergic asthma have concomitant rhinitis symptoms	24
International cross-sectional European Community Respiratory Health Survey (ECRHS) showed that 74% to 81% of subjects with asthma reported rhinitis, depending on sensitization to specific allergens	25
A population-based study of 15-69 year-olds in Denmark showed that all subjects with allergic asthma to pollen had in addition allergic rhinitis to pollen	26
Cross-sectional, population-based survey across six countries in Western Europe showed that 29% of subjects have persistent AR according to ARIA classification	27
Pathophysiological	
There are similarities in the types and activity of nasal and bronchial epithelial cells, mucous glands, goblet cells, and parasympathetic and sympathetic innervations	28,29
Changes in the primary nasal functional parameters (failure to filter allergens/warm and humidify inspired air, and viral infection in the nose) may lead to increased bronchial responsiveness and decreased lung function	28,29
A nasal bronchial reflex mechanism may account for the interaction between nose and lungs	30
Agents such as allergens, cold air, histamine, and aspirin trigger exacerbations of both asthma and rhinitis	29,31
Allergen challenge in upper and lower airways leads to increased recruitment of T cells, expression of the Th2 cytokines and eosinophils	32
In 20% to 30% patients with chronic allergic airway disease, allergen challenge in the upper airways results in significantly reduced lung function (decreased forced expiratory volume in 1sec (FEV_1) and forced vital capacity (FVC)) as well as increased bronchial responsiveness to methacholine	33,34
Nasal allergen challenge in mite sensitized subjects with AR and AR + asthma increased eosinophilic inflammation in both the upper and lower airways	35
In patients with seasonal rhinitis, nasal allergen challenge increased both sputum eosinophils and bronchial responsiveness to methacholine	36
In subjects with AR, segmental bronchial provocation with allergen induced allergic inflammation in the bronchial as well as nasal mucosa	37,38
Impact of AR symptoms on concomitant asthma	
Worsening rhinitis negatively affected the course of asthma in primary care patients; with more severe rhinitis being associated with worst asthma control and substantial impairment of quality of life	19,21
High nasal symptom scores in subjects with persistent rhinitis were associated with bronchial symptoms and bronchial hyper-responsiveness	40
AR as a risk factor for asthma	
Only AR and sensitisation to mites found to be associated with 2.71-fold increased risk of asthma, in a longitudinal population-based study in 14 Western European countries.	44
Longitudinal population-based studies have demonstrated that AR was an independent risk factor for onset-asthma in adults and children	45-49

AR = allergic rhinitis

immunoglobulin E (sIgE) tests can be useful to confirm sensitivity to avoidable triggers and are vital when considering avoidance regimes or allergen-specific treatments such as immunotherapy. Allergy tests are not diagnostic when considered independently of the clinical history and should not be used as a tool to 'screen' for allergic triggers.

What is the evidence for a link between rhinitis and asthma?

- *Epidemiological and pathophysiological studies have consistently indicated that rhinitis and asthma frequently co-exist[21,24-49] (see Table 2).*

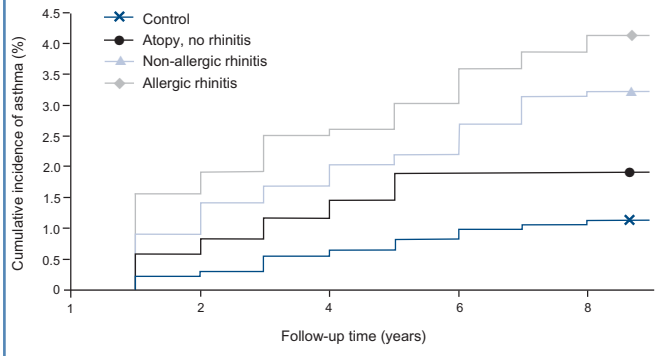
Epidemiological studies have demonstrated that approximately 20-60% of patients with rhinitis have clinical asthma, while >80% of patients with allergic asthma have concomitant rhinitis symptoms.[24-26] Based on the ARIA classification,[23] about one-third of all AR patients have persistent symptoms.[27]

Pathophysiological studies have provided compelling evidence for both anatomical and physiological similarities between the nose and the bronchi,[28-30] as well as there being common agents which can trigger both asthma and rhinitis exacerbations and lead to similar inflammatory responses.[29,31,32] Indeed, evidence from some studies suggests that in 20-30% of patients with chronic allergic airway disease, allergen challenge in the upper airways results in significantly reduced lung function[33] and increased bronchial responsiveness to methacholine.[33,34] Furthermore, allergen challenge in the nasal or bronchial airways leads to marked inflammatory responses in the lower[35,36] or upper airways.[37,38] Recently, it has been suggested that systemic inflammation triggered by both the adaptive and innate immune system may be the major factor involved in initiating and perpetuating inflammation in combined airway diseases.[39]

Studies directly investigating the impact of AR on the incidence of asthma have further indicated that worsening AR negatively affects the course of asthma.[19,21,40] One cross-sectional survey of over 4400 asthmatic patients recruited from 85 general practices in the UK indicated that the odds of having poor asthma control were more than doubled among patients with mild rhinitis and more than quadrupled among patients with severe rhinitis, compared to patients with no rhinitis.[19]

Studies investigating the effects of intranasal corticosteroids (INS) on asthma symptoms in subjects with co-morbid AR and asthma have reported conflicting results with regard to the benefits on asthma symptoms.[41] Moreover, a meta-analysis of studies assessing the efficacy of INS failed to show a significant effect on asthma outcomes.[42] A more recent study, however, has indicated that mometasone furoate nasal spray, a minimally bioavailable nasal corticosteroid, improved the quality of life (QoL) and the burden of respiratory symptoms in patients with persistent AR and asthma.[43]

Figure 2. Association of rhinitis with onset and incidence of asthma



Reprinted with permission from *Lancet* - Copyright Clearance Center's RightsLink service. Elsevier
http://s100.copyright.com/CustomerAdmin/PLF.jsp?lID=2011031_1300473086245
License number 2632060014245.
Reference: - Shaaban R, Zureik M, Soussan D, Neukirch C, Heinrich J, Sunyer J, Wjst M, Cerveri I, Pin I, Bousquet J, Jarvis D, Burney PG, Neukirch F, Leynaert B. Rhinitis and onset of asthma: a longitudinal population-based study. *Lancet* 2008;**372**:1049-57.

- *Rhinitis often precedes the development of asthma and is one of the strongest independent risk factors for the onset and incidence of asthma (see Figure 2).*[44]
  A considerable body of evidence suggests that AR is one of the strongest independent risk factors for asthma.[44-49] Population-based longitudinal studies have demonstrated that childhood AR is associated with a significantly increased risk of incident asthma during pre-adolescence, middle age or adult life;[47] whereas AR with sensitisation to mite[44] and pet allergens and smoking[48] is associated with an increased risk of onset of asthma.

Asthma and rhinitis as co-morbid conditions

a) What are the implications for primary care physicians?

- *The presence of co-morbid rhinitis and asthma in the majority of patients with asthma may result in logistic, financial, diagnostic and management challenges for primary care.* The logistic challenges are likely to be associated with more asthma-related GP visits and hospital referrals, with associated higher costs.[50,51] Diagnostic and patient-management challenges, however, are less clear.

b) Diagnosis of co-morbid rhinitis and asthma

- *Current guidelines recommend that people with asthma are assessed for rhinitis, and vice versa, so that their symptoms can be managed optimally.*[23]
  This is important because, irrespective of the level of asthma control, patients with rhinitis symptoms have significantly worse health-related QoL compared to patients without, or with a low level of, rhinitis symptoms.[52]
- *Co-existence of rhinitis and asthma may not be recognised by the patient or the clinician.*
  Some patients do not perceive rhinitis symptoms as impairing their social life, school and work, and therefore do not complain or seek medical advice.[23] Furthermore, it is important to distinguish between allergic and non-allergic symptoms as well as between persistent and/or moderate symptoms,[23] since this may influence choice of pharmacotherapy. The diagnosis of asthma is also technically more complicated and it may be confused by the presence of cough caused by rhinitis and postnasal drip leading to either inaccurate diagnosis or assessment of asthma severity[53]

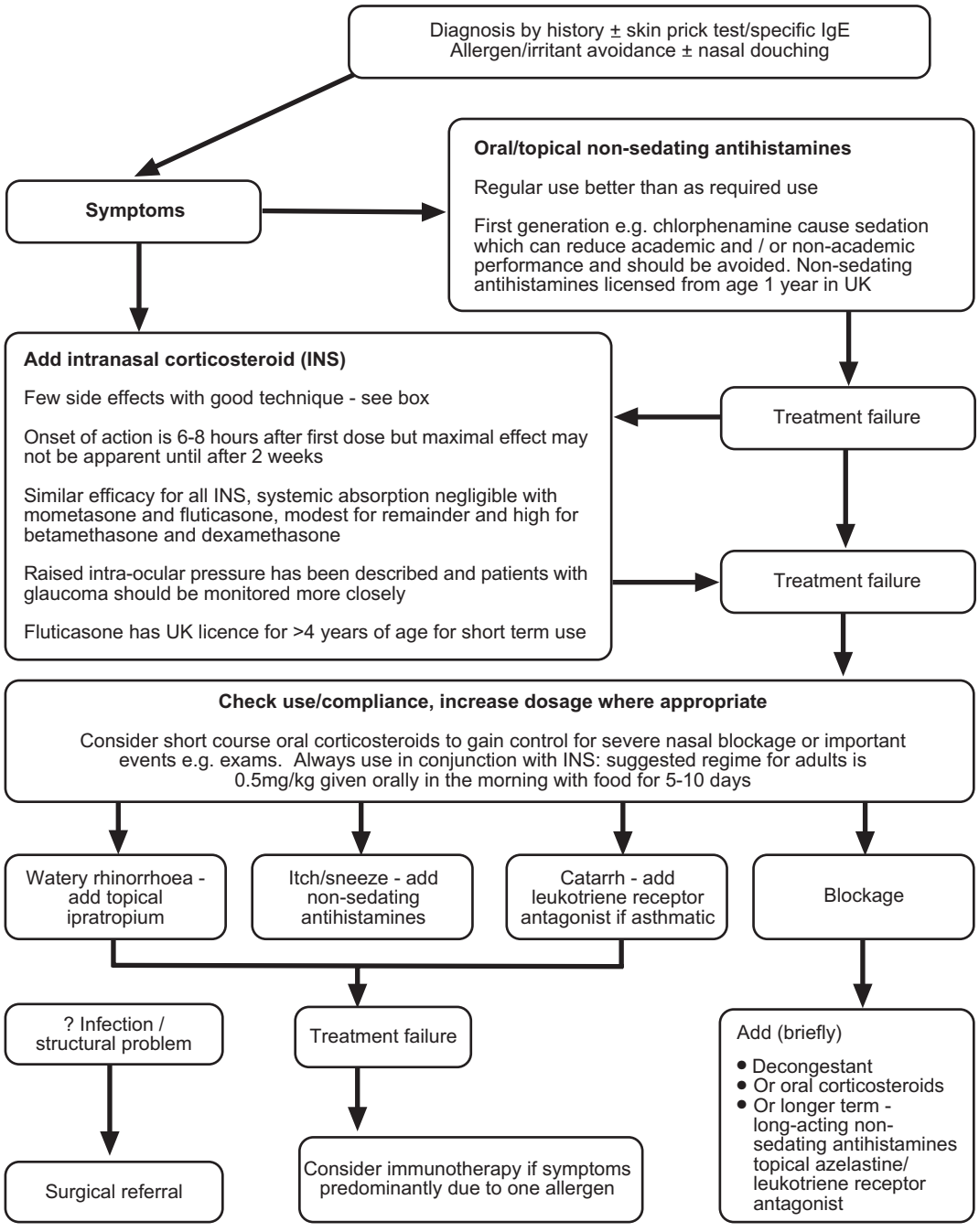
c) Management of patients with co-morbid rhinitis and asthma

- *Increasing evidence suggests that better management of rhinitis may result in decreased asthma morbidity.*
  Unlike the individual treatment strategies for rhinitis and asthma which are well established, the strategy and optimal therapeutic options for the treatment of co-morbid asthma and rhinitis are currently unclear – i.e. should each condition be treated individually or concurrently, and which therapy option should be employed? Current treatment options for asthma and rhinitis are similar and well documented, and include tertiary prevention (preventive strategies for management of established rhinitis and asthma), pharmacological treatments, and immunotherapy.[23,54-56] Moreover, a review of studies investigating the efficacy of commonly employed pharmacological treatments of rhinitis on asthma outcomes has indicated that intranasal glucocorticosteroids, antihistamines, anti-leukotrienes and immunotherapy all have the potential to improve both rhinitis and asthma outcomes in patients with both conditions.[55]
- *Guidelines indicate that pharmacological agents traditionally used for treatment of rhinitis may reduce asthma morbidity and thus they recommend a combined treatment strategy for the upper and lower airways for better efficacy:safety ratio.*[23]

d) How should you treat and monitor rhinitis in patients with poor asthma control?

- *Current rhinitis management guidelines recommend treatment according to an algorithm based on symptoms and severity (see Figure 3).*[22]
  - Oral/topical non-sedating antihistamines, and topical INS are the first-line medications of choice for mild and moderate/severe nasal symptoms, respectively. Cromone and antihistamine-containing eye drops can be used alone or in combination with the oral/topical non-sedating antihistamines and INS for ocular symptoms.
  - Special care should be taken in pregnancy and young children, particularly with use of decongestants.
- *Compliance with treatment should be monitored regularly until patients reach a level of optimal symptom control*

Figure 3. Algorithm for the treatment of rhinitis



Reprinted with permission from *Primary Care Respiratory Journal* - [DOI: http://dx.doi.org/10.4104/pcrj.2010.00044]
Reference: - Angier E, Willington J, Scadding G, Holmes S, Walker S. Management of allergic and non-allergic rhinitis: a primary care summary of the BSACI guideline. *Prim Care Respir J* 2010;**19**(3):217-222. DOI: http://dx.doi.org/10.4104/pcrj.2010.00044)

- To encourage compliance, all treatment options should be explained to patients and parents of children with rhinitis
- The correct technique for use of nasal sprays should be demonstrated to all patients (see Figure 4)[56] in order to optimise benefit and reduce local side effects such as nose bleeds and nasal crusting.[56,57]

Conclusions

Substantial epidemiological and pathophysiological evidence indicates that rhinitis and asthma frequently occur as co-morbid conditions in adults and paediatric patients, and that they may be considered as different manifestations of the same inflammatory disease continuum. Rhinitis is a powerful predictor of adult-onset asthma and impacts negatively on the course of

Figure 4. Correct procedure for using a nasal spray

1. Shake bottle well
2. Look down
3. Using RIGHT hand for LEFT nostril put nozzle just inside nose aiming towards outside wall
4. Squirt once or twice (2 different directions)
5. Change hands and repeat for other side
6. DO NOT SNIFF HARD

Adapted from Scadding GK, Durham SR, Mirakian R, *et al*. BSACI guidelines for the management of allergic and non-allergic rhinitis. *Clin Exp Allergy* 2008;**38**:19-42. (full permission obtained)

more severe asthma, worsening asthma control and impaired QOL as rhinitis severity increases, despite compliance with asthma treatment. Evidence suggests that more aggressive and better treatment of rhinitis is likely to improve asthma outcomes and asthma control, thus emphasising the ARIA-WHO recommendation that patients with asthma and rhinitis should be treated for both conditions. The combination of intranasal corticosteroids for persistent rhinitis and appropriate inhaled asthma therapy should be considered in such patients, with the addition of other drugs including cromones, anti-histamines and leukotriene receptor-antagonists as required. Overall steroid load should be reviewed on a regular basis to prevent unwanted side effects.

Acknowledgements Although not fulfilling the criteria for authorship, the authors gratefully acknowledge the editorial assistance provided by Dr Jagdish Devalia of JD Medical and Scientific Communications Limited which was funded by GlaxoSmithKline (GSK).

Conflicts of interest GS declares honoraria for lecturing, chairing meetings, and advising ALK, GSK, Merck, Stallergenes and Uriach, all of whom make treatments for rhinitis. She has received research funding from ALK, GSK and Merck. SW is a full-time employee of Asthma UK, and declares financial support from Boehringer Ingelheim for international conference attendance.

Contributorship Both authors conceived and wrote the first draft with editorial assistance provided by Jagdish Devalia. GS was responsible for the revision changes. Both authors approved the final version and are solely responsible for its content.

Funding Editorial assistance was funded by GSK.

References

1. Global Initiative for Asthma (GINA). Revised 2002: Global Strategy for Asthma Management and Prevention. http://www.ginasthma.org/
2. National Heart, Lung, and Blood Institute (NHLBI). Expert Panel Report 2: Guidelines for the Diagnosis and Management of Asthma. Full Report 1997. http://www.nhlbi.nih.gov/guidelines/archives/epr-2/asthgdln_archive.pdf
3. British Thoracic Society (BTS). British Guideline on the Management of Asthma. Thorax 2003; 58 Suppl 1.http://www.brit-thoracic.org.uk.
4. Canadian Thoracic Society (CTS). Adult asthma consensus guidelines update 2003. http://www.lung.ca/cts-sct/pdf/Adult_Asthma_Consensus.pdf.
5. Bateman ED, Hurd SS, Barnes PJ, *et al*. Global strategy for asthma management and prevention: GINA executive summary. *Eur Respir J* 2008;**31**:143-78. http://dx.doi.org/10.1183/09031936.00138707
6. Calhoun WJ, Sutton LB, Emmett A, Dorinsky PM. Asthma variability in patients previously treated with beta2-agonists alone. *J Allergy Clin Immunol* 2003;**112**: 1088-94. http://dx.doi.org/10.1016/j.jaci.2003.09.044
7. Pedersen S. From asthma severity to control: a shift in clinical practice. *Prim Care Respir J* 2010;**19**:3-9. http://dx.doi.org/10.4104/pcrj.2009.00059
8. Bateman ED, Boushey HA, Bousquet J, *et al*. GOAL Investigators Group. Can guideline-defined asthma control be achieved? The Gaining Optimal Asthma ControL study. *Am J Respir Crit Care Med* 2004;**170**(8):836-44. http://dx.doi.org/10.1164/rccm.200401-033OC
9. Bateman ED, Bousquet J, Busse WW, *et al*. GOAL Steering Committee and Investigators. Stability of asthma control with regular treatment: an analysis of the Gaining Optimal Asthma controL (GOAL) study. *Allergy* 2008;**63**(7):932-8. http://dx.doi.org/10.1111/j.1398-9995.2008.01724.x
10. Godard P, Greillier P, Pigearias B, Nachbaur G, Desfougeres JL, Attali V. Maintaining asthma control in persistent asthma: comparison of three strategies in a 6-month double-blind randomised study. *Respir Med* 2008;**102**(8):1124-31. http://dx.doi.org/10.1016/j.rmed.2008.03.014
11. Pauwels RA, Pedersen S, Busse WW, *et al*. START Investigators Group. Early intervention with budesonide in mild persistent asthma: a randomised, double-blind trial. *Lancet* 2003;**361**(9363):1071-6. http://dx.doi.org/10.1016/S0140-6736(03)12891-7
12. Bousquet J, Boulet LP, Peters MJ, *et al*. Budesonide/formoterol for maintenance and relief in uncontrolled asthma vs.high-dose salmeterol/fluticasone. *Respir Med* 2007; **101**(12): 2437-46. http://dx.doi.org/10.1016/j.rmed.2007.07.014
13. Busse WW, Shah SR, Somerville L, Parasuraman B, Martin P, Goldman M. Comparison of adjustable- and fixed-dose budesonide/formoterol pressurized metered-dose inhaler and fixed-dose fluticasone propionate/salmeterol dry powder inhaler in asthma patients. *J Allergy Clin Immunol* 2008;**121**(6):1407-14. http://dx.doi.org/10.1016/j.jaci.2008.03.019
14. Taylor DR, Bateman ED, Boulet LP, *et al*. A new perspective on concepts of asthma severity and control. *Eur Respir J* 2008;**32**:545-54. http://dx.doi.org/10.1183/ 09031936.00155307
15. Reddel HK, Taylor DR, Bateman ED, *et al*. American Thoracic Society/ European Respiratory Society Task Force on Asthma Control and Exacerbations. An official American Thoracic Society/European Respiratory Society statement: asthma control and exacerbations: standardizing endpoints for clinical asthma trials and clinical practice. *Am J Respir Crit Care Med* 2009;**180**:59-99. http://dx.doi.org/ 10.1164/rccm.200801-060ST
16. Levy ML. Guideline-defined asthma control: a challenge for primary care. *Eur Respir J* 2008;**31**:229-31. http://dx.doi.org/10.1183/09031936.00157507
17. Horne R, Price D, Cleland J, *et al*. Can asthma control be improved by understanding the patient's perspective? *BMC Pulm Med* 2007;**7**:8. http://dx.doi.org/ 10.1186/1471-2466-7-8
18. Corrigan CJ. Asthma therapy: there are guidelines and then there is real life… *Prim Care Resp J* 2011;**20**:13-14. http://dx.doi.org/10.4104/pcrj.2011.00016
19. Clatworthy J, Price D, Ryan D, Haughney J, Horne R. The value of self-report assessment of adherence, rhinitis and smoking in relation to asthma control. *Prim Care Respir J* 2009;**18**:300-05. http://dx.doi.org/10.4104/pcrj.2009.00037
20. Brandão HV, Cruz CS, Pinheiro MC, *et al*. Risk factors for ER visits due to asthma exacerbations in patients enrolled in a program for the control of asthma and allergic rhinitis in Feira de Santana, Brazil. *J Bras Pneumol* 2009;**35**:1168-73.
21. Magnan A, Meunier JP, Saugnac C, Gasteau J, Neukirch F. Frequency and impact of AR in asthma patients in everyday general medical practice: a French observational cross-sectional study. *Allergy* 2008;**63**:292-8. http://dx.doi.org/10.1111/j.1398-9995.2007.01584.x
22. Angier E, Willington J, Scadding G, Holmes S, Walker S. Management of allergic and non-allergic rhinitis: a primary care summary of the BSACI guideline. *Prim Care Resp J* 2010;**19**:217-22. http://dx.doi.org/10.4104/pcrj.2010.00044
23. Allergic Rhinitis and its Impact on Asthma (ARIA). http://www.whiar.org/Documents&Resources.php
24. Bousquet J, Vignola AM, Demoly P. Links between rhinitis and asthma. *Allergy* 2003; **58**:691-706. http://dx.doi.org/10.1034/j.1398-9995.2003.00105.x
25. Leynaert B, Neukirch C, Kony S, *et al*. Association between asthma and rhinitis according to atopic sensitization in a population-based study. *J Allergy Clin Immunol* 2004;**113**:86-93. http://dx.doi.org/10.1016/j.jaci.2003.10.010
26. Linneberg A, Henrik Nielsen N, Frolund L, Madsen F, Dirksen A, Jorgensen T. The link between AR and allergic asthma: a prospective population-based study. The Copenhagen Allergy Study. *Allergy* 2002;**57**:1048-52.

http://dx.doi.org/10.1034/ j.1398-9995.2002.23664.x
27. Bauchau V, Durham SR. Epidemiological characterization of the intermittent and persistent types of AR. *Allergy* 2005;**60**:350-3. http://dx.doi.org/10.1111/j.1398-9995.2005.00751.x
28. Slavin RG. The upper and lower airways: the epidemiological and pathophysiological connection. *Allergy asthma proc* 2008;**29**:553-6. http://dx.doi.org/10.2500/ aap.2008.29.3169
29. Simons FER. Allergic rhinobronchitis: the asthma-AR link. *J Allergy Clin Immunol* 1999;**104**:534-40. http://dx.doi.org/10.1016/S0091-6749(99)70320-9
30. Braunstahl GJ. The unified immune system: Respiratory tract nasobronchial interaction mechanisms in allergic airway disease. *J Allergy Clin Immunol* 2005; **115**:142-8. http://dx.doi.org/10.1016/j.jaci.2004.10.041
31. Rowe-Jones JM. The link between the nose and the lung, perennial rhinitis and asthma -is it the same disease? *Allergy* 1997;**52**(suppl 36):20-8. http://dx.doi.org/10.1111/j.1398-9995.1997.tb04818.x
32. Durham SR. Mechanisms of mucosal inflammation in the nose and lungs. *Clin Exp Allergy* 1998;**28**(Suppl 2):11-16.
33. Togias A. Mechanisms of nose-lung interaction. *Allergy* 1999;**54**(Suppl 57):94-105. http://dx.doi.org/10.1111/j.1398-9995.1999.tb04410.x
34. Corren J, Adinoff AD, Irvin CG. Changes in bronchial responsiveness following nasal provocation with allergen. *J Allergy Clin Immunol* 1992;**89**:611-18. http://dx.doi.org/10.1016/0091-6749(92)90329-Z
35. Inal A, Kendirli SG, Yilmaz M, Altintas DU, Karakoc GB, Erdogan S. Indices of lower airway inflammation in children monosensitized to house dust mite after nasal allergen challenge. *Allergy* 2008;**63**:1345-51. http://dx.doi.org/10.1111/j.1398-9995.2008.01694.x
36. Bonay M, Neukirch C, Grandsaigne M, *et al*. Changes in airway inflammation following nasal allergic challenge in patients with seasonal rhinitis. *Allergy* 2006;**61**: 111-18. http://dx.doi.org/10.1111/j.1398-9995.2006.00967.x
37. Braunstahl GJ, Overbeek SE, Fokkens WJ, *et al*. Segmental bronchoprovocation in AR patients affects mast cell and basophil numbers in nasal and bronchial mucosa. *Am J Respir Crit Care Med* 2001;**164**:858-65.
38. Braunstahl GJ, KleinJan A, Overbeek SE, Prins JB, Hoogsteden HC, Fokkens WJ. Segmental bronchial provocation induces nasal inflammation in AR patients. *Am J Respir Crit Care Med* 2000;**161**:2051-7.
39. Fasano MB. Combined airways: impact of upper airway on lower airway. *Curr Opin Otolaryngol Head Neck Surg* 2010;**18**:15-20. http://dx.doi.org/10.1097/ MOO.0b013e328334aa0e
40. Downie SR, Andersson M, Rimmer J, *et al*. Association between nasal and bronchial symptoms in subjects with persistent AR. *Allergy* 2004;**59**:320-6. http://dx.doi.org/10.1111/j.1398-9995.2003.00419.x
41. Thomas M. AR: evidence for impact on asthma. *BMC Pulm Med* 2006;**6** Suppl 1:S4. http://dx.doi.org/10.1186/1471-2466-6-S1-S4
42. Taramarcaz P, Gibson PG. Intranasal corticosteroids for asthma control in people with coexisting asthma and rhinitis. *Cochrane Database Sys Rev* 2003;4: CD003570.
43. Baiardini I, Villa E, Rogkakou A, *et al*. Effects of mometasone furoate on the quality of life: a randomized placebo-controlled trial in persistent allergic rhinitis and intermittent asthma using the Rhinasthma questionnaire. *Clin Exp Allergy* 2011;**41**: 417-23. http://dx.doi.org/10.1111/j.1365-2222.2010.03660.x
44. Shaaban R, Zureik M, Soussan D, *et al.* Rhinitis and onset of asthma: a longitudinal population-based study. *Lancet* 2008;**372**:1049-57. http://dx.doi.org/10.1016/ S0140-6736(08)61446-4
45. Guerra S, Sherrill DL, Martinez FD, Barbee RA. Rhinitis as an independent risk factor for adult-onset asthma. *J Allergy Clin Immunol* 2002;**109**:419-25. http://dx.doi.org/10.1067/mai.2002.121701
46. Leynaert B, Neukirch C, Kony S. Association between asthma and rhinitis according to atopic sensitization in a population-based study. *J Allergy Clin Immunol* 2004; **113**: 86-93. http://dx.doi.org/10.1016/j.jaci.2003.10.010
47. Burgess JA, Walters EH, Byrnes GB, *et al*. Childhood AR predicts asthma incidence and persistence to middle age: a longitudinal study. *J Allergy Clin Immunol* 2007; **120**:863-9. http://dx.doi.org/10.1016/j.jaci.2007.07.020
48. Plaschke PP, Janson C, Norrman E, Björnsson E, Ellbär S, Järvholm B. Onset and remission of AR and asthma and the relationship with atopic sensitization and smoking. *Am J Respir Crit Care Med* 2000;**162**:920-4.
49. Bugiani M, Carosso A, Migliore E, *et al*. AR and asthma comorbidity in a survey of young adults in Italy. *Allergy* 2005;**60**:165-70. http://dx.doi.org/10.1111/j.1398-9995.2005.00659.x
50. Price D, Zhang Q, Kocevar VS, Yin DD, Thomas M. Effect of a concomitant diagnosis of AR on asthma-related health care use by adults. *Clin Exp Allergy* 2005;**35**:282-7. http://dx.doi.org/10.1111/j.1365-2222.2005.02182.x
51. Crystal-Peters J, Neslusan CA, Smith MW, Togias A. Health care costs of AR-associated conditions vary with allergy season. *Ann Allergy Asthma Immunol* 2002;**89**:457-62. http://dx.doi.org/10.1016/S1081-1206(10)62081-9
52. Braido F, Baiardini I, Balestracci S, *et al.* Does asthma control correlate with quality of life related to upper and lower airways? A real life study. *Allergy* 2009;**64**:937-43. http://dx.doi.org/10.1111/j.1398-9995.2008.01932.x
53. Lack G. Pediatric AR and comorbid disorders. *J Allergy Clin Immunol* 2001;**108**(1 Suppl):S9-15. http://dx.doi.org/10.1067/mai.2001.115562
54. Sur DK, Scandale S. Treatment of AR. *Am Fam Physician* 2010;**81**:1440-6.
55. Nathan RA. Management of patients with AR and asthma: literature review. *South Med J* 2009;**102**:935-41. http://dx.doi.org/10.1097/SMJ.0b013e3181b01c68
56. Scadding GK, Durham SR, Mirakian R, *et al*. BSACI guidelines for the management of allergic and non-allergic rhinitis. *Clin Exp Allergy* 2008;**38**:19-42. http://dx.doi.org/10.1111/j.1365-2222.2007.02888.x
57. Walker S, Sheikh A. Rhinitis – 10-minute consultation. *BMJ* 2002;**324**:403. http://dx.doi.org/10.1136/bmj.324.7334.403

PERSPECTIVE

Management of co-morbid allergic rhinitis and asthma in a low and middle income healthcare setting

***Osman Mohammad Yusuf**[a]

[a] Chief Primary Care/GP Trainer and Consultant Allergy and Asthma Specialist, The Allergy & Asthma Institute, Islamabad, Pakistan

Rhinitis is a very commonly reported disease in low and middle income countries (LMICs).[1,2] Usually the paucity of facilities available to diagnose allergic disease and for differentiating between allergic and non-allergic forms of rhinitis leads to an over-reporting of "allergic" rhinitis, whereas in fact, allergy may not always be the cause.[3]

The use of terms like "hay fever", in which there is no involvement of hay, nor is there any fever, makes translations of literature and questionnaires into other languages difficult[4] – especially in languages where the words for "flu" infection

* Corresponding author: Dr Osman Mohammad Yusuf, The Allergy & Asthma Institute, 275 Gomal Road, Sector E-7, Islamabad, Pakistan 44000. Tel: (9251) 265 4445 Fax: (9251) 265 4446 E-mail: osman_allergy@yahoo.com