

ABSTRACT

Airborne allergens are environmental factors playing an important role in the development, persistence, and possibly severity of asthma. In Singapore, more than 80% of children with asthma above the age of 4 years are sensitized to dust mite allergens¹. Studies have shown that house-dust mite and cockroach exposure are linked to the prevalence of sensitization and subsequent development of asthma^{2,3}. In addition, allergen exposure can promote the persistence of airway inflammation and likelihood of an exacerbation. Substantially reducing such exposure may significantly reduce inflammation, symptoms, and need for medication.

SFP 2008; 34(3): 32-34

THE ROLE OF ALLERGEN AVOIDANCE

The important allergens for children and adults are those that are inhaled. Food allergens are NOT a common precipitant of asthma symptoms. For patients who have persistent asthma, an evaluation of exposure to indoor allergens is recommended. These would include the use of the patient's medical history to identify allergen exposures that may worsen the patient's asthma. Although not altogether specific, increased symptoms during vacuuming or bed making and decreased symptoms when away from home on a business trip or vacation are suggestive. In some circumstances, allergy testing may be necessary as a basis for education about the role of allergens for avoidance and possibly for immunotherapy. The skin prick testing or *in vitro* specific IgE testing can reliably determine sensitivity to perennial indoor inhalant allergens to which the patient is exposed. In Singapore, the relevant indoor allergens are: the house dust mite (*B. tropicalis*, *D. pteronyssinus*, *D. farinae*, cockroach, animal dander¹, and molds⁴.

Reducing house-dust mite exposure reduces asthma symptoms, nonspecific bronchial hyperresponsiveness, and evidence of active inflammation⁵. Education is an essential prerequisite for convincing patients about the need for specific allergen avoidance. Current recommendations for avoidance measures for dust-mite, cat, or cockroach allergens are allergen specific, and it is only possible to convince patients to undertake the measures once they know what they are allergic to.

Avoiding allergens is often difficult. Eight controlled trials have evaluated allergen-control interventions that combined

education for families about implementing allergen-control strategies with provision of tools and supplies needed to carry them out⁶. These studies suggest home-based education interventions, and the provision of tools for allergen control in high-risk asthma populations can reduce the burden of allergen exposure and affect asthma morbidity. More studies are needed to evaluate the cost-effectiveness and feasibility of widespread implementation of all allergen-control interventions delivered in patients' homes.

Despite these recommendations, the topic on allergen avoidance in allergic asthma is controversial. A recent Cochrane meta-analysis reviewed 54 trials (3,002 patients)⁷. 36 trials assessed physical methods (26 mattress encasings), 10 chemical methods, and 8 are combination of chemical and physical methods. They concluded that chemical and physical methods aimed at reducing exposure to house dust mite allergens cannot be recommended.

RECOMMENDATIONS ON HOUSE DUST MITE AVOIDANCE MEASURES

House dust mite-control measures require a multifaceted approach⁶. The highest levels of dust mite allergens are in the bedding, upholstered sofas and carpets.

The following are recommended actions to control house dust mites:

- ✕ Encase the mattress in an allergen-impermeable cover.
- ✕ Encase the pillow in an allergen-impermeable cover or wash it weekly.
- ✕ Wash the sheets and blankets on the patient's bed weekly in hot water.
- ✕ A temperature of >60°C is necessary for killing house-dust mites. Prolonged exposure to dry heat or freezing can also kill mites but does not remove allergen. If high temperature water is not available, a considerable reduction in live mites and mite allergens can still be achieved with cooler water and using detergent and bleach.
- ✕ Remove carpets from the bedroom.
- ✕ Avoid sleeping or lying on upholstered furniture.
- ✕ Remove carpets from home
- ✕ In children's beds, minimize the number of stuffed toys, and wash them weekly.

Chemical agents are available for killing mites and denaturing the antigen. However, the effects are not dramatic and do not appear to be maintained for long periods. Therefore, use of these agents in the homes of persons who have asthma and are sensitive to house-dust mites should not be recommended

routinely⁸. Vacuuming removes mite allergen from carpets but is inefficient at removing live mites. Room air-filtering devices are not recommended for control of mite allergens, because the allergens are associated with large particles which remain airborne for only a few minutes after disturbance. They are, therefore, not susceptible to removal by air filtration.

ALLERGEN IMMUNOTHERAPY

Allergen immunotherapy may be considered for patients who have persistent asthma if evidence is clear of a relationship between symptoms and exposure to an allergen to which the patient is sensitive. Immunotherapy is usually reserved for patients whose symptoms occur all year or during a major portion of the year and in whom controlling symptoms with pharmacologic management is difficult because the medication is ineffective, multiple medications are required, or the patient is not accepting the use of medication. Cost effectiveness has to be taken into consideration as well. However, reports that immunotherapy can prevent the development of new sensitivities in monosensitized children and adults⁹, and that immunotherapy with birch and timothy pollen extracts can prevent the development of asthma in children who have allergic rhinitis¹⁰, along with evidence of persisting effect for at least 3 years after discontinuation¹¹, suggest that immunotherapy should be considered when there is a significant allergic contribution to the patient's symptoms. A meta-analysis of 75 randomized, placebo-controlled studies has confirmed the effectiveness of immunotherapy in asthma, with a significant reduction in asthma symptoms and medication, and with improvement in bronchial hyperreactivity¹². This meta-analysis included 36 trials for allergy to house dust mites, 20 for pollen allergy, and 10 for animal dander. On the other hand, only three trials for mold allergy and only six trials with multiple allergen therapy were included.

The course of allergen immunotherapy is typically of 3–5 years' duration. Severe and sometimes fatal reactions to immunotherapy, especially severe bronchoconstriction, are more frequent among patients who have asthma, particularly those who have poorly controlled asthma, compared with those who have allergic rhinitis¹³. If use of subcutaneous allergen immunotherapy is elected, it should be administered only in a physician's office where facilities and trained personnel are available to treat any life-threatening reaction that can, but rarely does, occur. For this reason, enthusiasm for the use of immunotherapy in asthma differs considerably among experts. In Europe and some parts of Asia, interest has increased in high-dose sublingual immunotherapy. It has been reported to be effective in asthma, with benefit persisting 4–5 years after its discontinuation¹⁴, and to be free of systemic reactions, thus allowing home administration. Comparative studies suggest it is less effective, however, than immunotherapy administered by subcutaneous injection¹⁵.

ALLERGENS AND PREVENTION OF ASTHMA

Other than preventing tobacco smoke exposure both in utero and after birth, there are no proven and widely accepted interventions that can prevent the development of asthma. Exposure to tobacco smoke, both prenatally and postnatally, is associated with measurable harmful effects, including effects on lung development and a greater risk of developing wheezing illnesses in childhood¹⁶. Pregnant women and parents of young children should be advised not to smoke.

The role of diet, particularly breast-feeding, in relation to the development of asthma has been extensively studied. In general, infants fed with formulas of intact cow's milk or soy protein – compared with breast milk – have a higher incidence of wheezing illnesses in early childhood¹⁷. This may be related to protection from viral respiratory infections. Exclusive breast-feeding during the first months after birth is associated with lower asthma rates during childhood¹⁸. Use of an extensively hydrolyzed infant formula does not appear to decrease the incidence of asthma¹⁹. While strict avoidance of proteins, such as cow's milk or hens' eggs, reduces the incidence of atopic dermatitis in the first year of life, it does not prevent the development of asthma²⁰. Studies on obesity and asthma offer general advice to avoid excess weight gain and maintain a lifestyle that includes a balanced diet²¹.

REFERENCES

1. Chew FT, Lim SH, Goh DY, Lee BW. Sensitization to local dust-mite fauna in Singapore. *Allergy*. 1999 Nov;54(11):1150-9.
2. Huss K, Adkinson NF Jr, Eggleston PA, Dawson C, Van Natta ML, Hamilton RG. House dust mite and cockroach exposure are strong risk factors for positive allergy skin test responses in the Childhood Asthma Management Program. *J Allergy Clin Immunol* 2001;107(1):48-54.
3. Sporik R, Holgate ST, Platts-Mills TA, Cogswell JJ. Exposure to house-dust mite allergen (Der p I) and the development of asthma in childhood. A prospective study. *N Engl J Med* 1990;323(8):502-7.
4. Chew FT, Lim SH, Shang HS, Dahlia MD, Goh DY, Lee BW, Tan HT, Tan TK. Evaluation of the allergenicity of tropical pollen and airborne spores in Singapore. *Allergy*. 2000 Apr;55(4):340-7.
5. Morgan WJ, Crain EF, Gruchalla RS, O'Connor GT, Kattan M, Evans R III, Stout J, Malindzak G, Smartt E, Plaut M, et al.; Inner-City Asthma Study Group. Results of a home-based environmental intervention among urban children with asthma. *N Engl J Med* 2004;351(11):1068-80.
6. National Heart Lung and Blood Institute. National Asthma Education and Prevention Program. Expert Panel Report 3. Guidelines for the Diagnosis and Management of Asthma. 2007.
7. Gøtzsche PC, Johansen HK. House dust mite control measures for asthma. *Cochrane Database Syst Rev*. 2008 Apr 16;(2):CD001187. Review.
8. Woodfolk JA, Hayden ML, Couture N, Platts-Mills TA. Chemical treatment of carpets to reduce allergen: comparison of the effects of tannic acid and other treatments on proteins derived from dust mites and cats. *J Allergy Clin Immunol* 1995;96(3):325-33.
9. Pajno GB, Barberio G, De Luca F, Morabito L, Parmiani S. Prevention of new sensitizations in asthmatic children monosensitized to house dust mite by specific immunotherapy. A six-year follow-up study. *Clin Exp Allergy* 2001;31(9):1392-7.

10. Moller C, Dreborg S, Ferdousi HA, Halken S, Host A, Jacobsen L, Koivikko A, Koller DY, Niggemann B, Norberg LA, et al. Pollen immunotherapy reduces the development of asthma in children with seasonal rhinoconjunctivitis (the PAT-study). *J Allergy Clin Immunol* 2002;109(2):251-6.
11. Durham SR, Walker SM, Varga EM, Jacobson MR, O'Brien F, Noble W, Till SJ, Hamid QA, Nouri-Aria KT. Long-term clinical efficacy of grass-pollen immunotherapy. *N Engl J Med* 1999;341(7):468-75.
12. Abramson MJ, Puy RM, Weiner JM. Allergen immunotherapy for asthma. *Cochrane Database Syst Rev* 2003;(4):CD001186.
13. Bernstein DI, Wanner M, Borish L, Liss GM; Immunotherapy Committee, American Academy Allergy, Asthma and Immunology. Twelve-year survey of fatal reactions to allergen injections and skin testing: 1990-2001. *J Allergy Clin Immunol* 2004;113(6):1129-36.
14. Di Rienzo V, Marcucci F, Puccinelli P, Parmiani S, Frati F, Sensi L, Canonica GW, Passalacqua G. Long-lasting effect of sublingual immunotherapy in children with asthma due to house dust mite: a 10-year prospective study. *Clin Exp Allergy* 2003;33(2):206-10.
15. Khinchi MS, Poulsen LK, Carat F, Andre C, Hansen AB, Malling HJ. Clinical efficacy of sublingual and subcutaneous birch pollen allergen-specific immunotherapy: a randomized, placebo-controlled, double-blind, double-dummy study. *Allergy* 2004;59(1):45-53.
16. Dezateux C, Stocks J, Dundas I, Fletcher ME. Impaired airway function and wheezing in infancy: the influence of maternal smoking and a genetic predisposition to asthma. *Am J Respir Crit Care Med* 1999;159:403-10.
17. Friedman NJ, Zeiger RS. The role of breast-feeding in the development of allergies and asthma. *J Allergy Clin Immunol* 2005;115:1238-48.
18. Gdalevich M, Mimouni D, Mimouni M. Breast-feeding and the risk of bronchial asthma in childhood: a systematic review with meta-analysis of prospective studies. *J Pediatr* 2001;139:261-6.
19. von Berg A, Koletzko S, Filipiak-Pittroff B, Laubereau B, Grubl A, Wichmann HE et al. Certain hydrolyzed formulas reduce the incidence of atopic dermatitis but not that of asthma: three-year results of the German Infant Nutritional Intervention Study. *J Allergy Clin Immunol* 2007;119:718-725.
20. von Berg A, Koletzko S, Grubl A, Filipiak-Pittroff B, Wichmann HE, Bauer CP et al. The effect of hydrolyzed cow's milk formula for allergy prevention in the first year of life: the German Infant Nutritional Intervention Study, a randomized double-blind trial. *J Allergy Clin Immunol* 2003;111:533-40.
21. Flaherman V, Rutherford GW. A meta-analysis of the effect of high weight on asthma. *Arch Dis Child* 2006;91:334-39.

LEARNING POINTS

- Up to 80 to 90% of persistent asthma in children above 5 years and young adults are allergic. In Singapore, house dust mites (*D. pteronyssinus*, *D. farina*, and *B. tropicalis*) are the predominant inhalant allergen involved.
 - Allergen avoidance measures should be considered as part of the educational program in those with persistent asthma. Allergen avoidance measures should be multifaceted to be effective. A recent Cochrane meta-analysis, however, has concluded that physical and chemical methods to reduce dust mite exposure are ineffective in improving asthma control.
 - Specific allergen immunotherapy is an additional therapeutic modality in allergic asthma. Patients with few allergen sensitizations have better outcomes than those with multiple allergen sensitizations. It may be considered in patients who are reluctant to undergo pharmacotherapy.
 - In the prevention of asthma, the avoidance of prenatal and postnatal passive tobacco smoke exposure is the only factor widely accepted as being important.
-