

Editorial

Was the lung as target organ in food allergy underestimated?

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Although symptoms of food allergy most commonly affect the skin, clinicians have long recognized lower respiratory symptoms that arise from allergic reactions to foods. In his initial studies, Samson evaluated 113 children with atopic dermatitis for food hypersensitivity (1). Besides frequent cutaneous and gastrointestinal symptoms, respiratory reactions were observed in one-third of the children with positive food challenges. Moreover, symptoms involving the lower respiratory tract in children with asthma could be linked to an increased risk of severe reactions. Samson et al. (2) then described 13 fatal and near-fatal anaphylactic reactions to foods in children and adolescents. One of the most striking findings was that the respiratory symptoms, not cardiovascular shock, determined the severity of the food-induced anaphylactic reaction. Furthermore, all 13 patients had a history of asthma to common aeroallergens and were on chronic treatment for asthma. Other authors confirmed these findings, and Bock et al. recently reported 32 fatalities due to anaphylactic reactions to foods with, in all but one patient (in whom the presence of asthma could be determined), a positive history for asthma (3). In his discussion, he highlighted that fact that “the cases reported here strongly implicate the association of asthma with fatal reactions”.

In these studies, allergic reactions to foods occurred most often after ingestion of the offending allergen. More recently, the specific problem of allergic reactions to peanuts on commercial airliners brought to our attention the problem of inhaled food particles in the pathogenesis of food allergy. In a study by Sicherer et al., 14 out of 35 of subjects reporting an allergic reaction to peanut on a plane only reacted to inhaled foods (4). However, none of these reactions occurred

immediately after possible exposure to the food. One subject with a severe reaction began to react 40 minutes after peanuts were served. Two other subjects had reactions before the peanuts were distributed. Although inhalation of peanut was possible, doubt remained for some of these reactions. The same authors also gathered data from peanut allergic and tree-nut allergic children who had reactions in school or daycare (5, 6). Out of 124 reactions described, 16 were possibly related to inhalation. The risk of aerosolized particles for children with known food allergies was often underestimated, as bird-feeders craft projects involving bird food containing peanuts were organized in the presence of these children. Foods containing peanuts and eaten by classmates in the presence of peanut-allergic patients were also frequently involved. We recently published in *Allergy* an internet-based survey on anaphylaxis to foods (7). In a follow-up study on the circumstances of food-induced reactions, additional information was obtained from 51 subjects (8). Three of the subjects reacted after inhalation, and all of these reactions were rated as severe. The first case occurred in the cabin of a cruise-ship when a patient with known fish allergy smelled fish fumes and had to self-inject epinephrine (adrenaline). The second, another subject with fish allergy, reacted after inhalation of fish allergens during a meal; his treatment also consisted of an injection of epinephrine (adrenaline). The last patient reacted after air contact with food contaminated by peanuts.

Respiratory reactions after food challenges have been further characterized by lung function testing. James et al. monitored 88 children after double-blind, placebo-controlled food challenges (DBPCFC) (9). Of these, 13 developed signs of lower respiratory symptoms. Although the symptoms were clinically obvious, only

six patients had a decrease greater than 20% in FEV₁ (forced expiratory volume in one second). The changes in lung function were most often observed within minutes after the onset of dyspnea or wheezing, and lasted no longer than 1 h. No late-phase reactions were observed during the 3 h follow-up. The same author then evaluated airway hyperresponsiveness after DBPCFC in 26 food allergic, asthmatic patients (10). Significant increases in airway hyperresponsiveness were observed in seven of 12 patients experiencing chest symptoms after positive DBPCFC. Decreasing FEV₁ was generally not observed in these patients. These findings suggested that a significant increase in methacholine sensitivity may occur without changes in conventional spirometry, and that allergic reactions to food might influence bronchial hyperresponsiveness without overt symptoms of asthma.

In this issue of *Allergy*, Robert et al. report on 12 children with IgE-mediated food allergy with a history of asthma after open inhalation of the offending food (11). This group of patients underwent a bronchial food challenge by exposure to fumes of cooking food in a small challenge room. Five challenges were positive with fish, chickpea and buckwheat. Four challenges were negative with milk or eggs. Peak expiratory flow rates were monitored for up to 21 h. Patients with positive challenges experienced a significant drop in peak flow rates with a similar pattern to that observed by James et al. (9). However, 5–7 h later a late-phase reaction was observed, similar to that observed in asthma with inhalant aeroallergens. Interestingly, these patients reported improvement in their chronic asthma symptoms after completely avoiding fumes of the foods to which they were allergic.

The significance of this study might affect many more patients than the minority with food allergies who react overtly to inhaled food allergens. In particular, patients with chronic asthma and food allergy might be evaluated not only by oral food challenges and standard spirometry, but also for bronchial reactivity and by bronchial food challenges. If an involvement of food allergy in chronic lung symptoms is suspected, there should be strict avoidance of exposure to inhalant food allergens, and changes in asthma and bronchial reactivity should be carefully assessed. This could benefit not only patients with recognized chest symptoms after food inhalation but also patients who do not complain of overt symptoms. Furthermore, sensitization to foods is suspected to occur in the gut. However, the skin and/or respiratory tract might represent other sites. It remains to be determined whether this explains the intriguing finding of positive skin tests in young children who had never knowingly ingested specific foods. Such a finding would have practical implications for food-allergy prevention measures, involving avoiding inhalation of potentially harmful foods. These remarks are highly speculative but deserve further investigation.

Finally, the study by Roberts et al. raises many more questions regarding the allergenic fractions involved: the doses of allergen responsible for symptoms; the role of heat denaturation; why certain allergens (milk and eggs) seem to be less allergenic as airborne particles. Future studies might provide additional evidence for the clinical implications of these findings, as well as further explanations for the pathogenesis of food allergy (12).

References

1. SAMPSON HA, McCASKILL CC. Food hypersensitivity and atopic dermatitis. evaluation of 113 patients. *J Pediatr* 1985;**107**:669–675.
2. SAMPSON HA, MENDELSON LM, ROSEN JP. Fatal and near-fatal anaphylactic reactions to food in children and adolescents. *N Engl J Med* 1992;**327**:380–384.
3. BOCK SA, MUNOZ-FURLONG A, SAMPSON HA. Fatalities due to anaphylactic reactions to foods. *J Allergy Clin Immunol* 2001;**107**:191–193.
4. SICHERER SH, FURLONG TJ, DESIMONE J, SAMPSON HA. Self-reported allergic reactions to peanut on commercial airliners. *J Allergy Clin Immunol* 1999;**104**:186–189.
5. SICHERER SH, FURLONG TJ, DESIMONE J, SAMPSON HA. The US Peanut and Tree Nut Allergy Registry: Characteristics of reactions in schools and day care. *J Pediatr* 2001;**138**:560–565.
6. SICHERER SH, FURLONG TJ, MUNOZ-FURLONG A, BURKS AW, SAMPSON HA. A voluntary registry for peanut and tree nut allergy: Characteristics of the first 5149 registrants. *J Allergy Clin Immunol* 2001;**108**:128–132.
7. EIGENMANN PA, PASTORE FD, ZAMORA SA. An internet-based survey of anaphylactic reactions to foods. *Allergy* 2001;**56**:540–543.
8. EIGENMANN PA, ZAMORA SA. An internet-based survey on the circumstances of food-induced reactions following the diagnosis of IgE-mediated food allergy. *Allergy* 2002;**57**:449–453.
8. JAMES JM, BERNHISEL-BROADBENT J, SAMPSON HA. Respiratory reactions provoked by double-blind food challenges in children. *Am J Respir Crit Care Med* 1994;**149**:59–64.
10. JAMES JM, EIGENMANN PA, EGGLESTON PA, SAMPSON HA. Airway reactivity changes in food-allergic, asthmatic children undergoing double-blind placebo-controlled food challenges. *Am J Respir Crit Care Med* 1996;**153**:597–603.
11. ROBERTS G, GOLDBERGER N, LACK G. Bronchial challenges with aerosolized food in asthmatic, food-allergic patients. *Allergy* 2002;**57**:713–718.
12. JOHANSSON SGO, HOURIHANE JO'B, et al. A revised nomenclature for allergy. An EAACI position statement from the EAACI nomenclature task force. *Allergy* 2001;**56**:813–824.