Peanut Allergy

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GOAL

To review the presentation, evaluation, and treatment for peanut allergy

OBJECTIVES

1. To delineate the presentation of peanut allergy.
2. To discuss the methods of diagnosis for peanut allergy.
3. To describe treatment options, including desensitization, of peanut allergy.

CME Test on page 298

Peanut allergy is acute and severe with symptoms of immediate hypersensitivity. This allergy is very common, affecting 1% of preschoolers. The incidence has increased with succeeding generations, and is possibly due to the increasing exposure of children to peanuts at a young age. Diagnosis is via history, skin prick test, and serum IgE level. The mainstay of therapy is avoidance. Treatment of anaphylaxis includes epinephrine and antihistamines. Children usually will not outgrow this food allergy. Novel treatment with rush immunotherapy and enzyme-potentiated desensitization is not currently acceptable. We describe a 27-month-old Asian boy with a typical presentation of peanut hypersensitivity. A good understanding of the epidemiology of this illness is necessary for treatment and prevention.

Peanut allergy was not a well-known entity until recently. An Ovid® Medline search revealed an increase in publications on the topic from less than five articles to more than 25 articles per year during the last decade (Figure 1). This trend correlated well with the incidence of peanut allergy. Peanut allergy is more common now than past generations,[1] and the incidence is approaching 1% in preschoolers.[2] Unlike other food allergies, peanut allergy is more often life-threatening, and is also the least likely to be outgrown.[2] Peanut allergy is caused by IgE-mediated hypersensitivity.[3] Anaphylaxis and airway obstruction are the causes of death in most cases.

Case Report

A 27-month-old Asian boy with a history of mild atopic dermatitis presented with periorbital edema resembling "raccoon eyes" (Figure 2), vomiting, and diarrhea with onset a few minutes after ingestion of a teaspoon of peanut butter. His angioedema promptly responded to 1 teaspoon of Benadryl® syrup; however, his irritability and diarrhea continued for 2 more days. The child had never had contact with peanut products prior to presentation. His mother had consumed peanut products during and after her pregnancy, but the child had not been breast-fed. His family history was significant for asthma and seasonal allergy. A skin prick test (SPT) 1 week later was strongly positive to peanut allergen, with a wheal response exceeding 4 cm on the forearm. The parents were advised to carry epinephrine at all times, and to avoid all nut products, chocolate, and Oriental restaurants.

Comments

This case points to the changing epidemiology of food allergy. Peanut allergy is characterized by more severe symptoms than other food allergies. Most of these symptoms are IgE-mediated.[3] Children with peanut allergy are more likely to suffer from other IgE-mediated ill-

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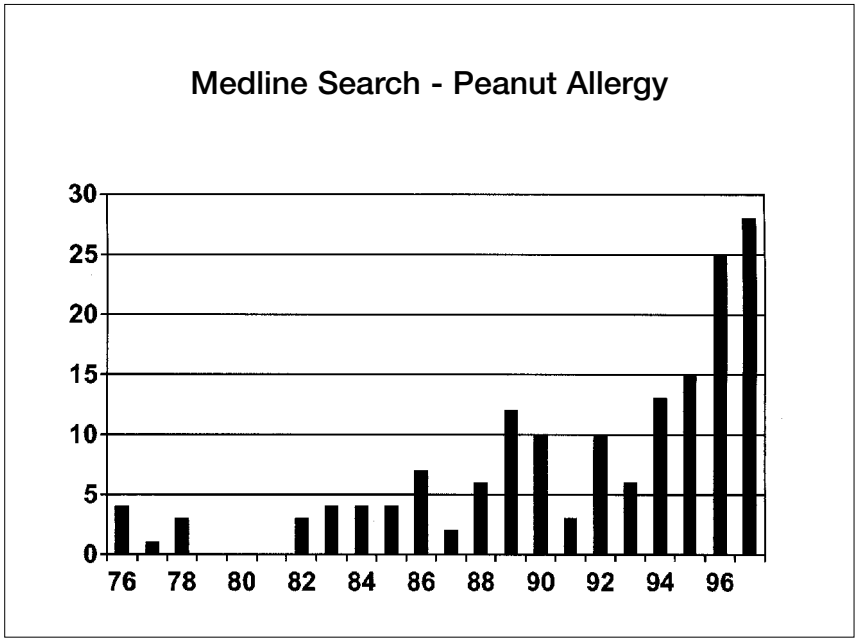

FIGURE 1. Ovid® Medline search results by year for peanut allergy in title, abstract, or subheading.

nesses than non-peanut-sensitive subjects, including asthma (46% vs. 14%),[2] eczema (62% vs. 11%),[2] and allergic rhinitis (31% vs. 5%).[2] They are also more likely to be allergic to tree nuts.[4] The symptoms of peanut allergy include: facial swelling (60%); itch (52%); rash (51%); wheeze (40%); breathing difficulty (38%); vomiting (35%); abdominal cramp or pain (21%); cyanosis (9%); and collapse or fainting (7%).[5]

Fatal and near-fatal reactions are rapid and due to airway obstructions. The peak age of fatal reactions is during the teenage years, and is correlated with a peak in serum IgE level.[5] Fatal anaphylactic reactions are most likely to occur away from home, frequently at school, and especially in children with asthma.[3,6,7] Many, possibly most, of the fatal reactions could have been prevented with rapid access to epinephrine injection.[6]

The diagnosis of peanut allergy is by clinical history and ancillary tests such as the SPT and specific IgE antibody level.[8] Oral challenge with peanut product is confirmatory, but is not recommended due to a small risk of fatal reaction even with prompt treatment. Oral challenge should be done only in a hospital setting by personnel familiar with pediatric Advanced Cardiac Life Support and available emergency airway support. SPT is performed by a small prick with a sharp needle on the forearm at the site of a drop of food allergen. Reactions are measured in millimeters and compared with a histamine and a saline control. SPT is highly predictive of the absence of peanut allergy if negative.[9] Because 30% of subjects who are tolerant of peanut can have a positive SPT,[9] a positive result is only supportive of the clinical history, and is not diagnostic in itself. Rarely a negative SPT is seen in a peanut-allergic individual. In this case, serum IgE to peanut can be determined, and a high level is correlated with the diagnosis.[8]

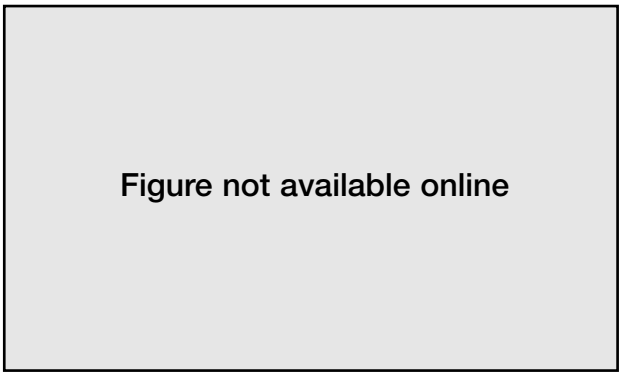

FIGURE 2. A 27-month-old child 5 hours after exposure to peanut shows residual periorbital angioedema initially described as "raccoon eyes."

Peanut (*Arachis hypogaea*) is a legume closely related to peas and beans. Other legumes include peas, beans, soy beans, kidney beans, garbanzo beans, carob beans, clover, lupines, and lentils. The difference between peanut and the other beans is that after pollination, the flower stalk elongates, bends downward to the earth, and buries its fruit in the soil to mature. Peanuts have been cultivated since approximately 2000 BC.[3] Peanut allergy sufferers can consume most other legumes safely,[4] and should be allowed to do so.[3] Few reported cases of concurrent peanut allergy and allergy to lupine (found in some pasta, bread, cookies, and milk substitute) and taugeh (small green beans used in Asian food) have been noted.[9] Tree

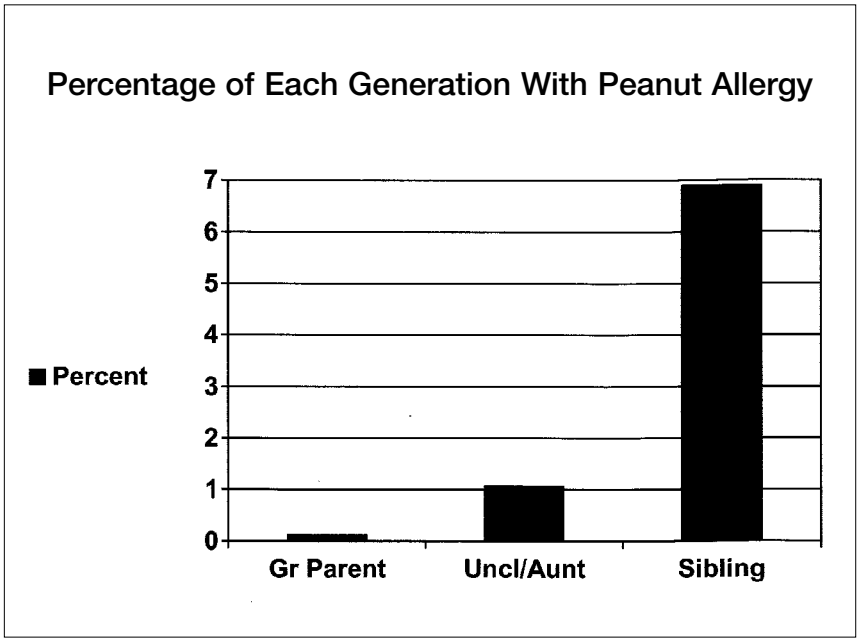

FIGURE 3. Percentage of each generational group of subjects with peanut allergy. Grouping includes grandparents, uncles, aunts, parents, and subjects with their siblings.[1]

nuts, which are not legumes, should be avoided by patients who suffer from peanut allergy.[8]

Peanut is composed of up to 32 different proteins. An important peanut allergen, *ara*-h 1, belongs to the vicilin family of seed storage protein and is recognized by more than 90% of peanut-allergic individuals.[10] This protein has been cloned and synthesized for better understanding of the pathophysiology of this disease.[11] Two other allergens, *ara*-h 2 and *ara*-h 3, have also been identified and studied.[12] Unfortunately, 18 protein bands in crude peanut extract were able to bind specific IgE in serum from peanut-allergic individuals; thus, more work is needed to identify the full spectrum of allergen in peanut.[12]

The prevalence of peanut allergy has increased over the last 2 decades, and is likely due to the increase in consumption of peanut products and the younger age of exposure. It is believed that early exposure to food allergens increases the chance of developing food allergy.[13] The average American consumes 11 pounds of peanut products each year[13]; 80% of infants are exposed to peanut before their first birthday, and 100% by the second birthday. Sources of early-age exposure to peanut include diaper rash ointment,[14] baby massage oil,[15] and baby milk formulas.[16] Less frequently thought-of sources of peanut include dust in an airplane,[17] topical medication (ie, Derma-smooth/FS®), and the base ingredient of vitamin D supplements.[18]

It is not surprising that allergic reactions to peanut have increased by nearly 100% during a 10-year period.[13] In families of peanut allergy sufferers, with each succeeding generation, from grandparents to uncles, aunts, and parents, to the patient's own siblings,[1] the incidence of peanut allergy increases exponentially (Figure 3), suggesting a genetic predisposition in the face of increasing exposure to peanut. With reports of breast milk as a source for exposure to food allergens,[19] peanut certainly should be avoided by mothers breastfeeding their infants with known peanut allergy, or in mothers with a strong family history of peanut allergy or atopy.

The treatment of peanut allergy at this time is strict avoidance of any peanut products and perhaps even peanut oil. Peanut oil is frequently noted to be safe for peanut allergy sufferers[20]; however, several brands of minimally processed peanut oils have been shown to contain peanut allergen,[21] and four infants developed atopic dermatitis from peanut oil-containing baby formulas.[16] Unless one can be sure of the source of peanut oil, it is probably best to avoid products with peanut oil. Peanut is such a potent allergen that some patients have had a positive SPT to a dilution of 1:10,000,000.[22] Some individuals have suffered a reaction just being near peanuts or an open jar of peanut butter.[23] Minute amounts of peanut in food can result from contaminated cooking utensils, direct or indirect contact between foods, inhaling fumes during cooking, kissing a person who has consumed or touched peanut products, unlabeled or unspecified food ingredients such as "spices" or "natural flavorings," and eating out.[17,22-24]

Nut-flavored food or candies should be avoided by peanut sufferers due to possible contamination with, or due to the use of, deflavored peanuts. Deflavored peanuts can be reflavored and sold as other nuts, and might not be noted on an ingredient label if added

in small amounts.[22] Peanut-sensitive individuals are often advised to avoid chocolate candies; they are frequently contaminated in processing with nut products. Many companies cannot or will not guarantee the safety of their products due to the chance of cross-contamination with peanuts from other food products in the same plant.

The Food and Drug Administration (FDA) has started requiring food manufacturers to list all potential allergens on their ingredient labels as of June 1996.[23] However, some manufacturers might still be slow to catch up, or are not aware of this FDA requirement. Imported food, small bakeries, and restaurants are a high risk for individuals with severe peanut allergy, as they might not be aware of, nor would rigorously follow, the FDA requirements. National-brand bakery products might be safer than those of local producers; the former are more likely to have the capital to invest in distinct processing machinery and transport equipment for peanut-free products, and they also have more personal liabilities from a larger distribution standpoint.

A cure for peanut allergy is currently not available. Treatment of anaphylaxis is by the use of epinephrine injections (an auto injector such as EpiPen® or EpiPen Jr®), oral antihistamines (diphenhydramine or hydroxyzine), and prompt transport to a hospital setting.[13,25] About one-third of patients with fatal or near-fatal reactions experienced recurrence of anaphylactic symptoms within 4 hours, so more than one epinephrine dose might be needed, and observation for extended time in a hospital setting might be required.[13]

Unlike other food allergies, one does not usually "outgrow" the hypersensitivity to peanut.[9,13] A recent study noted that a small percentage of peanut allergy sufferers can actually "outgrow" their allergy.[26] The authors' conclusions were that peanut allergy rarely resolves in older children and adults, and that those whose allergy resolved are likely to have fewer symptoms of atopy than those whose allergy persists. Other findings concluded that allergy to other foods was less common in resolvers than persisters, and the SPT results in the resolvers were more likely to be smaller (<6 mm) than the persisters.

Rush immunotherapy with peanut extract injection was successful in increasing the tolerance of an individual to oral challenges with peanut; however, high rates of systemic reactions to the treatment make rush immunotherapy unacceptable for now.[27] Enzyme-potentiated desensitization (EPD), or enzyme-potentiated hyposensitization, was developed by McEwen [28-30] in the 1960s, and has been touted as being effective for the treatment of "hay fever, dust mite allergy, perennial rhinitis, asthma, urticaria, eczema, angioedema, anaphylactic reactions, food allergy or intolerance, adverse responses to chemicals, attention deficit hyperactivity disorder, autism, irritable bowel disorders, Crohns' disease, ulcerative colitis, migraine and other headaches, rheumatoid arthritis, ankylosing spondylitis, and systemic lupus erythematosis."[31] EPD has been praised by some[32]; however, it has also been severely criticized by others, especially on the Internet by physician discussion groups.

EPD is administered by the use of beta-glucuronidase or hyaluronidase and a mixture of allergens as an intradermal injection or as topical application onto a "scarified" area of the skin via a "cup."[28,33] One successful treatment was reported with EPD and an egg-allergic patient,[28] but EPD was not successful in a peanut-allergic individual.[28] Elaborate preparation pre- and posttreatment is required (chelation therapy, strict dietary regimens, avoidance of numerous allergens including pets, and pretreatment with antifungals, antiparasitics, and antibiotics), and contributes greatly to the cost and confounding variables to the ongoing research on this method.[34] None of the 17 published references available on EPD indicated success in curing peanut allergy. Currently, the Internet and Online physician discussion groups are the only source of unpublished and anecdotal success with the treatment of anaphylaxis due to food.

In summary, peanut allergy is becoming more prevalent. The chance is great that with the incidence approaching 1% in young patients, we will treat children with peanut allergy. The treatment choices currently are limited, aside from avoidance. It is not until we recognize the cause and epidemiology of this increasingly prevalent allergy that we can curb the spread of the illness. If it is true that prenatal or perinatal exposure to peanut allergen can cause this hypersensitivity, then we can proceed to prevent it. Obstetricians should tell pregnant patients to avoid all peanut products, and pediatricians should give nursing mothers the same advice. Commercial and local food industries and granaries will need to keep distinct and separate equipment, trucks, storage, and processing machinery for peanut-containing products and peanut-free products.

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Dr. Pham reports no conflict of interest.