

The Management of Food Allergy

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KEY CONCEPTS

- Management of food allergy consists of educating patients to avoid potential allergens and teaching them to recognize and initiate treatment of allergic reactions due to accidental ingestions.
- Reading all ingredient labels is the best way to prevent accidental allergen ingestions.
- At the present time, there is no consensus on whether dietary manipulation is useful in the prevention of food allergies and other atopic disorders.
- Having a family member with a food allergy affects the quality of life of the entire family.
- All patients at risk for severe allergic reactions should receive an emergency plan and medications for initiating treatment of allergic reactions.
- A large majority of accidental ingestions leading to anaphylactic reactions occur outside the home at restaurants and social gatherings.

Introduction

Allergic reactions to foods encompass a spectrum of symptoms ranging from mild to life-threatening to fatal anaphylactic reactions. The relationship of a food to a reaction may be very clear, as in an acute IgE-mediated reaction following peanut ingestion. In such cases, elimination of the food should prevent the onset of symptoms. The overall contribution of a food to the production of atopic dermatitis or eosinophilic gastroenteritis may be less understood, however, and elimination of the offending antigen may not necessarily result in complete resolution of the disease.

For patients who have food allergies, avoidance of the offending food is the key to preventing an allergic reaction. Unfortunately, complete avoidance is difficult to achieve, because food allergens can be hidden in other foods. Therefore, all patients need written instructions for emergency management of a reaction. Treatment of food allergy may include attempts to prevent sensitization, medications to prevent or palliate symptoms associated with ingestion of the antigen, and possibly oral immunotherapy, a recent development.

Allergen avoidance

The best strategic approach to the management of true food hypersensitivity is complete avoidance of the allergen. It is critical to provide patients with adequate information about the allergen, including the types of food in which it may be found and the various terms that are used to identify the allergen on an ingredient statement.

Allergen identification

Close to 200 foods have been reported as causing an allergic reaction [1]. However, the foods most commonly implicated in food-allergic patients in the United States are egg, peanut, milk, soy, wheat, fish, shellfish, tree nuts (pecans, almonds, walnuts, pistachio nuts, cashews, hazelnuts, Brazil nuts, etc.) and sesame seed [2]. Although avoidance of the offending food with careful menu planning and label reading would appear reasonably possible, it is actually quite challenging. The literature is replete with reports of accidental exposures of food-sensitive individuals to the very antigen they are striving to avoid [3–7]. Even minute quantities of an allergen may provoke serious reactions in extremely sensitive patients [8,9]. The following discussion identifies potential problem areas and provides suggestions for educating patients in avoidance strategies.

Label reading

Food-allergic individuals should read the ingredient label on all foods. This step ought to be repeated every time they shop, because ingredients may change without warning. Label reading for some can take as much as 2 hours each time they go to the grocery store. Ingredient statements should also be read for bath products and cosmetics, as some contain extracts from common food allergens such as almonds or milk. Pet food sometimes contains wheat, eggs, milk, or peanuts. Children have had a reaction after being licked by a dog that had ingested food containing a food allergen. Because toddlers may eat things they find on the floor, including pet food, extra-care and attention should be given when selecting pet food. Medications, such as Benadryl Fast Melts®, contain allergens, further emphasizing the need for ingredient-label reading for all products all the time.

To minimize the chance of missing an allergen, families report reading the ingredient label 3 times: at the store, before they put the groceries away at home, and before they serve the food to the allergic child. Some say they only noticed the allergen during the third reading, thus justifying to themselves the need for this extra-cautious approach. Others read the label backwards to ensure careful scrutiny.

To properly avoid the food to which they are allergic, patients must learn the scientific and technical names for foods that may appear on labels. For example, the presence of milk protein may be indicated as *whey* or *ammonium caseinate*; eggs as *albumin* or *globulin* (Table 36.1). Joshi reported that of 91 sets of parents participating in a label reading study in an allergy clinic, less than 10% of those avoiding milk were able to spot the “milk words” on a label, only 54% of those avoiding peanuts correctly identified peanuts on a label, and just 22% correctly identified soy [10]. Ninety percent of the parents with near perfect scores in label reading were members of the Food Allergy and Anaphylaxis Network (FAAN), supporting the need for proper education of label reading for patients and their families.

Table 36.1 Partial list of synonyms for common food allergens

<i>Milk protein</i>	<i>Wheat protein</i>
Ammonium caseinate	Semolina
Casein	Cracker meal
Curds	
Whey	<i>Peanuts</i>
Ghee	Valencias
Non-dairy	Monkey nut
	Ground nut
<i>Soy protein</i>	Beer nuts
Edamame	
Shoyu sauce	

FAAN (Fairfax, VA: 800-929-4040, www.foodallergy.org) provides wallet-size laminated or magnetic cards to make label reading easier. These “How to Read a Label” cards contain lists of synonyms and ciphers under which milk, egg, wheat, peanut, soy, fish, shellfish, and tree nuts may masquerade. The cards are updated regularly, as new terms are identified.

Understanding kosher rules and markings can make label reading easier. A “D” indicates that a product contains dairy products, even if its presence is not disclosed on the ingredient statement. Products that list a “D” on the front label but may not list milk in the ingredient statement include some brands of tuna, sliced bread and bread sticks, breakfast cereals, cookies, imitation butter flavor, pancake syrup, pretzels, fruit snacks, cake mixes, and frostings. The designation “D.E.” (dairy equipment) on a label signifies that the product was manufactured on equipment also used to produce dairy-containing food. As a result, the product might contain trace amounts of milk protein [11].

“Pareve” or “Parve” on a label indicates that a rabbinical agency has determined that the product does not contain dairy. However, under Jewish law, a food product may contain a small amount of milk and still meet religious specifications for “pareve” [10]. Anaphylaxis was reported in one milk-sensitive child after ingestion of pareve-labeled food [12]. As a result, products labeled “pareve” may not be safe for those with milk allergy.

A food allergen labeling law which went into effect January 1, 2006, should simplify the task of label reading; however, the new law will certainly not solve all of the issues related to allergen labeling.

The Food Allergen Labeling and Consumer Protection Act (FALCPA) mandates that packaged food items must declare, in plain language, the presence of a major food allergen: (1) in the ingredient list; (2) via a “Contains *allergen*” statement; or (3) by use of a parenthetical statement following a scientific ingredient term, for example “albumin (egg).” In the case of fish, shellfish, and tree nuts, the specific type must be listed, for example salmon, shrimp, cashew.

The labeling requirements of FALCPA also apply to allergens in colorings, flavorings, and spices. Previously, allergens were simply listed under collective terms such as “Natural Flavors.”

FALCPA, however, fails to remedy the problem of advisory labeling, or “May Contain” statements, the use of which has proliferated in recent years. These allergen advisory statements are voluntary; as a result, manufacturers have their own decision trees for when and what statement to use on a product. Examples of these statements include: “May Contain Peanuts;” “Processed in a Facility That Also Processes Nuts;” “Manufactured in a Plant That Also Processes Milk, Eggs, and Wheat;” and “Manufactured on Shared Equipment With Nuts.”

Many patients report frustration at their diminishing food choices as the proliferation of products with these advisory statements appears on the market; others have chosen to ignore these statements completely. This should be discouraged. The food industry indicates that these labeling messages are designed to alert patients that there is a chance the product may contain the allergen listed on the advisory statement. The US Food and Drug Administration (FDA) has notified the industry that these allergen advisory statements are not to be used in place of good manufacturing practices [13]. Until there are set guidelines or regulations for the conditions under which these statements may be used, it is best to err on the side of caution and avoid these products. A recent study by Hefle *et al.* found that 2 of 51 (4%) products labeled as “May Contain,” 3 of 57 (5%) products labeled as being produced on “shared equipment,” and 7 of 68 (10%) of those labeled as being produced in a “shared facility” in fact contained the food allergen [14]. These investigators also found an increasing disregard for such labels by food-allergic patients.

Another remaining labeling loophole is the use of the term “non-dairy” in food that contains milk-derived proteins such as casein or caseinates. Examples of foods listed as non-dairy that may contain milk include coffee whiteners, whipped toppings, and imitation cheeses. A number of reactions have occurred to children whose family members believed “non-dairy” to mean “no dairy” and did not read the ingredient statement on the back of the package.

A labeling practice that may pose a threat to patients is the listing of the food allergen as the last ingredient. Patients have reported ingesting products with the allergen as the last ingredient. Having suffered no reaction, the patients determine that the ingredient is not present or that they are no longer allergic. Neither can be assumed. In one case, a young teen consumed a baked good that listed peanut flour as the last ingredient, allegedly telling her friend that she’d done this before without having a reaction. Unfortunately, the product did contain peanuts and she died a short time later from her reaction.

Patients are advised to call the food manufacturer if they have difficulty interpreting a food label. To get the information they are looking for, patients must be as specific as possible, for example, ask “Does this product contain soy?” rather than, “What does the ‘may contain’ statement mean?” Most large manufacturers will provide the specific allergen information. Companies who do not or cannot provide this are to be avoided. Imported foods may pose a risk, even though such foods are required to follow US labeling regulations. Labeling standards in other countries are not as strict as those in the United States, and US distributors often do not take responsibility for tracking down ingredient information from foreign sources [15]. Most of the products that cause reactions to individuals with peanut or tree nut allergy

are desserts or bakery products [5,16]. It is prudent to avoid these types of products unless it is prepared at home.

Some foods may appear to be so straightforward that the patient may not feel it necessary to scrutinize the ingredient label for allergens. Alternatively, the food product may be considered so unlikely to contain an allergen that the label is never reviewed (Table 36.2). Ingredient labels should be reviewed for all products.

Lists of commercially prepared “safe” foods are a popular request of busy parents looking for shortcuts in labeling reading. Manufacturers change ingredients without warning, making these lists potentially dangerous. A list of “safe” products can quickly become outdated and the incorrect information on the list can lead to a reaction, particularly since these lists are often copied and shared with caregivers, teachers, and others, and old lists may not be retrieved and replaced. In one example, a school and day care center published such a list and included a “peanut and tree nut safe” donut shop. Months later the establishment introduced a nut-containing product made on shared equipment with “plain” donuts. In another case, the parent of a child with milk allergy provided a list of safe products. The mother forgot to update the list when some of the products were reformulated to contain milk. The school staff was uncertain about whether the product or the mother’s list was safe.

Occasionally, a manufacturer makes a labeling or packaging error by including an undeclared allergen in a product, putting a product in the wrong packaging, or using an outdated label with incomplete ingredient information. These situations pose a special hazard to those with food allergies. The FDA requires products whose labels are

Table 36.2 Unexpected sources of common allergens

Food	Ingredient
Worcestershire sauce	Anchovies, sardines
Soy sauce	Wheat
Imitation butter flavor	Milk protein
Water-added ham, deli meats, some sausages and hot dogs	Milk or soy
Sweet and sour sauce	Wheat or soy
Sorbet	Egg
Sweet potato puree	Peanut
Pizza	Egg
Low fat peanut butter	Soy
Pet food*	Eggs, wheat, milk, peanuts, and soy
Cosmetic and bath products	Milk, tree nut, egg, wheat
Imitation crab legs	Wheat, fish, egg
Barbeque flavor potato crisps	milk
Pesto sauce	Peanuts, pistachio, walnut, pine nuts

*Toddlers may sample pet food off the floor.

incorrect to be recalled from the market. To quickly get the word out to the allergic community when these situations arise, FAAN has developed a Special Allergy Alert System. Information about the mistake, product name, code, and other criteria are sent via mail (to FAAN members only), e-mail (to anyone), and are placed on FAAN's web site (www.foodallergy.org). All patients who have food allergies should be encouraged to sign up for these free Special Allergy Alert Notices.

Cross-contact

Even with careful labeling, concealed allergens may still adulterate a food. Cross-contact can occur during the processing of foods. Although production lines are cleaned thoroughly between each product run, mistakes are sometimes made. It has been reported that some dark chocolate may be manufactured on the same line as milk-containing products (e.g. milk-chocolate), making contact with milk allergens possible [17].

Granola bars are often produced on the same line as products that contain peanuts or a variety of nuts, which could allow the granola bars to become contaminated with substances not listed on the label. One product can sometimes incorporate a stray ingredient from another product. For example, small pieces of peanuts or nuts can remain in the equipment after thorough cleaning, and become dislodged during the next production run [13].

Various types of nut butter, including peanut butter, are commonly run on the same production line, allowing contamination of subsequent products [13]. Ice cream containing nuts may be sieved to remove the nuts so that the base can be used for another flavor of ice cream. This policy may result in unsuspected contamination with nut allergen [18]. Food industry experts now recommend that companies put "like into like" when reusing materials [19]. Although large manufacturers heed this advice, small companies may not.

Other potential sources of cross-contact may occur in the grocery store. Bulk food bins may be used for a variety of products with little or no cleaning of the bins in between each change over, and shoppers may inadvertently transfer a scoop from one bin to another. Cheese is often sliced on the same equipment as deli meats, making cross-contact possible [13]. It is common practice to place various types of donuts, croissants, and muffins together in display cases, where they are likely to come into contact with one another or where the same serving tool is used for all.

Avoiding these types of high-risk foods will help minimize the patient's chances of suffering an accidental ingestion of the food to which they are allergic.

Cooking

Families must learn how to adapt recipes and make appropriate allergy-safe substitutions. Often the entire family

Sources of cross-contact

- Production/manufacturing lines
- Deli slicers
- Bulk food bins
- Bakery display cases
- Serving utensils and ice cream scoops
- Buffet-style restaurants.

elects to follow the restricted diet and avoids bringing the allergen into the home, so that home can be a safe place for the child. This also minimizes the amount of cooking needed and the chances for cross-contact between allergen-containing and allergen-free foods.

Some families choose to bring the allergen into the home and use it as an opportunity to role-play situations that the child may encounter outside of the home. These families often have designated areas of the pantry and refrigerator for the allergen-free foods; some place stickers on all food: green stickers to indicate "safe" foods and red stickers symbolizing "unsafe" foods [20]. This strategy helps the child and other family members avoid unsafe foods. Other families have used colored dishes, spoons, and glasses for the allergic child, thus keeping food allergy top-of-mind at all times.

If the allergen is present in the home, extra-care should be taken during cooking. The allergen-free meal may be prepared first, covered and removed from the cooking area to be sure it is not accidentally contaminated with the allergen. One mother reported causing a reaction in her milk-allergic son after mistakenly using the same serving spoon for his food after using it to serve cheese-containing food to the rest of the family.

Keeping an extra-supply of "safe" foods ready ensures that there is always something available for the allergic child especially on harried days or when a babysitter or other family member takes over the cooking responsibility.

There is no one-way to manage food allergies; each family must decide what strategies work best for them.

Day-to-day management

- All ingredient labels must be read – including foods, medications, bath and beauty products, and pet foods
- Patients should avoid eating food with "May Contain" type warnings
- Lists of "safe foods" quickly become out of date and should be discouraged
- Food allergens can appear in unexpected places, patients should be on alert at all times
- Desserts and bakery products cause the majority of peanut and tree nut reactions
- Cross-contact between allergens can occur during manufacturing, storing, or cooking.

Their decisions will have to be revisited as the child ages and takes more control of his or her food allergy management.

Psychosocial impact

The constant vigilance required to avoid a reaction can be a source of stress to the family. In a study of the impact of food allergy on the quality of life, Sicherer reported that childhood food allergy has a significant impact on general health perception, had an emotional impact on parents, and placed limitations on family activities [21]. Marklund showed similar results in a Swedish study of children age 8–9 years old. Both studies noted that families managing multiple food allergies or food allergy and other atopic diseases such as eczema experienced more stress and worry than families with only one food allergen to avoid. The Swedish study reported that the ability of families to get along is higher in families with food allergy. This may be, in part, because they must work together to keep the allergic family member safe [22]. A study of the daily impact of food allergy on children by Bollinger reported food allergy causes stress in the family and affects meal preparation. Ten percent of the respondents reported home schooling their child because of the food allergy [23].

Stress on the family may come from a number of sources. Parents may have to work around family members or friends who do not believe food allergies are dangerous, and who attempt to slip some of the restricted food to the child in an attempt to “prove” their theory to the child’s parents.

In the school setting, children with food allergies can be the targets of class bullies. Some have had reactions as a result of this bullying. In one case, a child was sprayed with milk and suffered an allergic reaction. In another, classmates threatened a student who was allergic to peanuts by telling him they were going to shove a peanut down his throat [24]. Schools have a responsibility to keep all children safe and to hold those who harass or tease others accountable.

Sometimes, a family that has adjusted to living with food allergy may experience a setback when their child has a reaction. If the parent served the food that caused the reaction, the parent may experience guilt or lose confidence in their ability to care for their child. Children who have suffered a severe reaction sometimes develop eating disorders. Some only eat one or two foods for long periods of time after a reaction. Others become withdrawn and extremely fearful, not trusting anyone else to read the ingredient label on their behalf. It is not uncommon for these children to experience panic attacks. Their siblings may also express anxiety, fearing that their brother or sister will die; some become jealous of the attention the parents give to the “at-risk” child.

Mothers of young children who have been diagnosed with food allergies have a unique set of stressors. Frequently they report feeling guilty for causing their child’s food allergies, particularly children that have been breastfed. These feelings are more intense in families where the mother

reports eating peanuts or tree nuts while pregnant or nursing and the child subsequently develops a peanut or tree nut allergy. Mothers also express remorse for the pain their child may have suffered before a diagnosis was made.

Parents need to know how serious a reaction could be and what they should do if one were to occur. Statements such as “You worry too much” or “You don’t want a prescription for epinephrine, it will change your life” minimize the potential seriousness of food allergy. However, statements such as “This child is so allergic he won’t be safe in school and must be home-schooled” or “This is the worst case I’ve ever seen” create an atmosphere of fear and dread. Some parents become so fearful they cannot function; they home-school their child and minimize contact with others in an effort to avoid a possible deadly reaction. Parents need to have a healthy balance of education and caution from their physician.

Messages that empower the parents ultimately benefit the child. The family must work to find a balance for their child between safety and social normalcy. Knowing that there are millions of students with food allergies across the country who participate in class activities, team sports, recreational camps, sleepovers, etc. shows parents that food allergies are manageable and they needn’t restrict their child’s social activities. Allowing the child to be part of the decision-making for food allergy management builds confidence in the child and prepares the child to successfully manage his or her food allergies later in life.

It is clear that food allergies affect the entire family. The psychological impact on the family can be intense, will change according to family events, and will differ among the parents, siblings, and the child who is allergic.

A follow-up visit with a physician and a registered dietitian a month or so after diagnosis and after severe allergic reactions may provide families the opportunity to ask questions and get information for handling situations that may have come up since the diagnosis. Parents who find their fears are impeding their day-to-day activities or whose children are showing signs of acute stress should be encouraged to speak with a professional counselor.

The psychosocial impact of food allergies

- Food allergy can create stress
- Food allergy can help build family unity in some families
- Children can be the target of harassment/bullying
- After a reaction, children and parents can become withdrawn and fearful
- Children can develop eating disorders after a reaction
- Parents sometimes feel guilty for creating their child’s food allergy
- Food allergy can limit family activities
- Parents need information that empowers them and educates them
- Food allergy impacts the entire family.

Teens and young adults: high-risk patients

Studies of fatal food-induced anaphylactic reactions have shown that high-risk patients include adolescents and young adults with food allergy (particularly peanut or tree nut allergy), and asthma. In a study of 32 fatal food allergy reactions, the largest study of its kind, 17 (54%) of the fatalities involved individuals aged 10–19 years [5]. This age group poses unique challenges: teens generally spend more time away from home in the company of their friends; often don’t carry their prescribed epinephrine (EpiPen® or Twinject®); try to treat anaphylaxis with asthma inhalers; and tend to go off alone when a reaction occurs.

In a study on risk-taking behaviors of adolescents and young adults affected by food allergy, 54% of the subjects indicated they purposefully ingested a potentially unsafe food; 42% indicated a willingness to eat a food labeled “May Contain;” and only 61% reported that they “always” carry their self-injectable epinephrine. However, upon further query, it appears the rate of carrying medications changes according to the social event or even the type of clothing they are wearing. Many teens reported carrying medication when going to a restaurant (84%), less than half (43%) do so when involved in sports. Wearing tight clothes (53%) or hanging out with friends (57%) were other reasons for not carrying medications [25].

In one tragic fatal anaphylaxis case, a teen went to the restroom alone and was discovered some time later by his friends. He was found clutching his asthma inhaler. In another case, a teen collapsed in front of her friends, who stood by and watched not knowing how to help.

These tragedies point to some critical lessons. Adolescents and young adults should be given specific information for managing their food allergies in a variety of new situations. They must be reminded that epinephrine is the medication of choice for handling a severe reaction, and that reactions are never planned. Teens want their friends to know about their food allergy, but they prefer to have the school staff educate them [25]. FAAN’s *Be A PAL: Protect A Life From Food Allergies* program and the *Friends Helping Friends* video/DVD are designed to simplify this educational task. There are several EpiPen®/Twinject® carriers on the market, which will make it easier for teens, especially boys, to carry their prescribed epinephrine. Pictures of these carriers appear on FAAN’s web site (www.foodallergy.org).

Adolescents and adults are high-risk patients

- Often spend time away from home with friends
- Exhibit risky behavior such as purposefully ingesting an allergen
- May not always carry their prescribed epinephrine
- Often confuse asthma and anaphylaxis symptoms and use asthma inhalers to treat anaphylaxis.

FAAN’s *Stories from the Heart: A Collection of Essays from Teens with Food Allergies* is a good resource for teaching teens that their concerns are universal, and that they can learn from what others have done to balance their food allergies and active social calendar. The FAAN teen web site (www.faanteen.org) also provides teens and their friends with a tech-savvy outlet to secure information and the support they need.

Management of food allergy at school

Food allergy affects an estimated 6–8% of young children [26]. In a school setting, one child’s food allergy is likely to impact the child’s friends and, in some cases, the entire class. Often, classmates avoid the food to which their friend is allergic so they can all eat together at lunch. In other cases, educators request that parents not send peanut- or nut-containing products for class celebrations. Some, particularly teachers of young children, designate their classroom to be food free.

In a survey of 400 elementary school nurses, 44% reported an increase in children with food allergies in their schools over the past 5 years; only 2% reported a decrease. More than one-third of the nurses reported having 10 or more students with food allergies [27].

As food allergy increases in the school setting, educators, struggling to keep up, continue to change and adapt lesson plans, policies for lunch time and class celebrations.

Elementary schools are frequently designating a “peanut- or milk-free” table in the cafeteria; others allow the children to eat in the library or another room outside the cafeteria with a few friends. Parents often fear that the smell of peanut butter will cause their child to have a life-threatening or fatal reaction. As a result, many demand that the school issue a peanut ban to keep their child safe. However, in a study by Simonte *et al.* to determine if casual contact with peanut butter would cause anaphylaxis, none of the patients (some of whom reported having reacted to the smell of peanut butter) experienced anaphylaxis from smelling peanut butter or from skin contact with peanut butter [28]. Some of the patients experienced local erythema, local pruritus, and a single hive following contact with peanut butter; however, they did not require medication.

Educators and parents are often concerned about removing peanut allergens from desks, tables, hands, and other surfaces. Investigators sampled a variety of cleaners’ ability to remove peanut residue. Perry *et al.* tested a number of cleaning products and reported that plain water, Formula 409 cleaner, Lysol Sanitizing Wipes and Target brand cleaner with bleach were most effective in removing peanut residue. Dishwashing liquid was ineffective [29].

Hand washing and the use of hand wipes are also a common practice in schools, particularly in elementary grades, to remove peanut residue. Perry’s group found the following to be most effective: Tidy Tykes Wipes, Wet Ones antibacterial

wipes, Liquid soap, Bar soap. Of note, water and hand sanitizer did not remove peanut from hands [29].

In an effort to control the risks, some schools provide non-food treats (pencils, stickers, etc.) in lieu of food, others require that foods sent in for class celebrations must be commercially prepared and contain preprinted ingredient statements, or request that the student's parents send in "safe" snacks for their child. Many schools hold yearly "in-service" training sessions, whereby appropriate staff members (teachers, aides, coaches, etc.) are instructed in recognizing an allergic reaction and administering auto-injectable epinephrine.

Nonetheless, food allergy reactions frequently occur in the school setting. In a telephone survey of 80 schools, Nowak *et al.* reported that 39% had at least one reaction to a food in the previous 2 years [26]. Some of the reactions in school are severe or fatal [4,5,30]. In spite of this, Nowak reported that 30% of 132 students with food allergies did not have physician's instructions or medication at school at the time of their reaction [26].

Reactions in schools are common, in part, because food is everywhere: in the cafeteria, in the classroom, on the playground, on the school bus, etc. Foods used in school projects or class celebrations [30,31] have caused reactions as have treats exchanged with well-meaning friends who believe the food to be safe [5]. In response, some schools have implemented a "no food trading" policy to prevent these types of reactions.

Two studies have shown that 25% of reactions in schools are first-time reactions [30,31]. Thus, school staff should learn the symptoms of a reaction and have a plan in place to get help quickly. Lack of written emergency action plans and insufficient staff training in the recognition of symptoms have been attributed to a delay in treatment of a reaction in some cases [4]. It is recommended that children with food allergies have a written plan for handling a reaction and for managing their food allergy day-to-day, on file at the school.

The development of the day-to-day plan should be a collaborative effort, with input from the child's teachers, the school principal, the school nurse, the child's physician, and the child's parents. Often, the written plan takes the form of an Individualized Health Care Plan, recommended by the National Association of School Nurses (NASN) [32].

FAAN's *Food Allergy Action Plan* (Fig. 36.1) is another tool employed by schools throughout the country. The one-page document (available in English and Spanish for free download from the FAAN web site) contains information crucial to managing the child's food allergy at school: the signs and symptoms of a reaction; directions for treatment; emergency contact information; an indication of which school staff members have received food allergy training; and directions for administering auto-injectable epinephrine.

The *School Food Allergy Program* (SFAP), produced by FAAN for school staff, includes a video or DVD, epinephrine

training devices, an awareness poster, and a binder filled with more than 100 pages of information and standardized forms. The SFAP, which has been distributed to more than 30,000 schools across the United States, was developed in conjunction with National Association of School Nurses, the National School Boards Association, the National Association of Elementary School Principals, and the National Association of Secondary School Principals.

Epinephrine is the medication of choice for managing an anaphylactic reaction. A review of epinephrine use in Massachusetts schools indicated that in one-fifth of the cases, the allergic reaction occurred outside the school building on the playground, traveling to and from school, and on field trips. Clearly, anaphylactic reactions in schools are not uncommon events, and are not confined primarily to the cafeteria [31]. To protect students, states throughout the country are changing laws and regulations to allow students, with a physician's and parent's permission, to carry their own epinephrine throughout the school day [33].

Occasionally, a school will turn away a child solely because of the child's food allergies. Children with life-threatening food allergies are considered *disabled* under federal civil rights laws, such as Section 504 (of the Rehabilitation Act) and the Americans with Disabilities Act (ADA). Under these laws, schools must address the health and safety needs of the child, and must provide accommodations to ensure that the child participates fully and equally in all normal facets of the school day [34]. There are many resources, including government agencies such as the Department of Civil Rights, available to assist families if they encounter discrimination at school because of their child's food allergies.

It is important to note that there is no "one-size-fits-all" approach to managing food allergies in the school setting. Each child's needs are different; as a result, management plans must be individualized, and may need to be revisited as the child gets older.

Managing food allergies at school

There is no "one-size-fits-all" approach

A written management plan, tailored to the needs of the individual child, will help ensure the child's safety at school
Appropriate school staff should be trained to recognize and treat a reaction

Lack of a written emergency action plan and quick access to epinephrine are believed to be a factor in fatal food allergy reactions

Schools are taking a number of approaches to managing food allergies, including no food trading, designated cafeteria seating, and food-free celebrations

A school-wide food allergy management plan should consider all places where food is found and develop a plan to minimize risks of a reaction.

Food Allergy Action plan

Students's Name:_____D.O.B:_____Teacher:_____

ALLERGY TO:_____

Asthmatic

Yes*☐

No☐

*Higher risk for severe reaction

Place Child's Picture Here

◆ STEP 1: TREATMENT ◆

Symptoms:		Give Checked Medication**:	
		**(To be determined by physician authorizing treatment)	
■	If a food allergen has been ingested, but <i>no symptoms</i> :	☐ Epinephrine	☐ Antihistamine
■	Mouth Itching, tingling, or swelling of lips, tongue, mouth	☐ Epinephrine	☐ Antihistamine
■	Skin Hives, itchy rash, swelling of the face or extremities	☐ Epinephrine	☐ Antihistamine
■	Gut Nausea, abdominal cramps, vomiting, diarrhea	☐ Epinephrine	☐ Antihistamine
■	Throat† Tightening of throat, hoarseness, hacking cough	☐ Epinephrine	☐ Antihistamine
■	Lung† Shortness of breath, repetitive coughing, wheezing	☐ Epinephrine	☐ Antihistamine
■	Heart† Weak or thready pulse, low blood pressure, fainting, pale, blueness	☐ Epinephrine	☐ Antihistamine
■	Other† _____	☐ Epinephrine	☐ Antihistamine
■	If reaction is progressing (several of the above areas affected), give:	☐ Epinephrine	☐ Antihistamine

†Potentially life-threatening. The severity of symptoms can quickly change.

DOSAGE

Epinephrine: inject intramuscularly (circle one) EpiPen® EpiPen® Jr., Twinject® 0.3 mg Twinject® 0.15 mg (see reverse side for instructions)

Antihistamine: give _____

medication/dose/route

Other: give _____

medication/dose/route

IMPORTANT: Asthma inhalers and/or antihistamines cannot be depended on to replace epinephrine in anaphylaxis.

◆ STEP 2: EMERGENCY CALLS ◆

1. Call 911 (or Rescue Squad:_____). State that an allergic reaction has been treated, and additional epinephrine may be needed.

2. Dr. _____ Phone Number: _____

3. Parent _____ Phone Number(s) _____

4. Emergency contacts:

Name/Relationship

Phone Number(s)

a. _____ 1. _____ 2. _____

b. _____ 1. _____ 2. _____

EVEN IF PARENT/GUARDIAN CANNOT BE REACHED, DO NOT HESITATE TO MEDICATE OR TAKE CHILD TO MEDICAL FACILITY!

Parent/Guardian's Signature _____

Date _____

Doctor's Signature _____

Date _____

(Required)

Figure 36.1 Food Allergy Action Plan.

TRAINED STAFF MEMBERS

1. _____
2. _____
3. _____

Room _____

Room _____

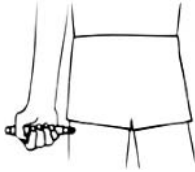
Room _____

EpiPen® and EpiPen® Jr. Directions

- Pull off gray activation cap.



- Hold black tip near outer thigh (always apply to thigh).



- Swing and jab firmly into outer thigh until Auto-Injector mechanism functions. Hold in place and count to 10. Remove the EpiPen® unit and massage the injection area for 10 seconds.

Twinject® 0.3 mg and Twinject® 0.15 mg Directions



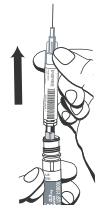
- Remove caps labeled "1" and "2."
- Place rounded tip against outer thigh, press down hard until needle penetrates. Hold for 10 seconds, then remove.



SECOND DOSE ADMINISTRATION:

If symptoms don't improve after 10 minutes, administer second dose:

- Unscrew rounded tip. Pull syringe from barrel by holding blue collar at needle base.
- Slide yellow collar off plunger.
- Put needle into thigh through skin, push plunger down all the way, and remove.



Once EpiPen® or Twinject® is used, call the Rescue Squad. Take the used unit with you to the Emergency Room. Plan to stay for observation at the Emergency Room for at least 4 hours.

For children with multiple food allergies, consider providing separate Action Plans for different foods.

***Medication checklist adapted from the Authorization of Emergency Treatment form developed by the Mount Sinai School of Medicine. Used with permission.*



June 2007

Figure 36.1 (Continued)

Eating away from home

When food is consumed that is not personally prepared and served in one's home, the risk of encountering a hidden allergen increases. As an example, a peanut-sensitive teenager made her own jam sandwich while on a camping trip [35]. She was not aware that the knife had been used earlier to spread peanut butter and had been wiped but not washed. She died minutes after eating the sandwich. Another individual suffered a reaction after eating ice cream that should not have contained nuts. It was later discovered that the wait staff mistakenly put the wrong flavor ice cream on the child's ice cream cone.

Food-allergic patients must be on heightened alert when dining away from home. Common ingredients can appear in unexpected places, for example eggs in meat loaf or peanut butter in meat sauce. Convincing the wait staff that food allergies are real, and that it is critical that they give accurate information about ingredients, are just some of the obstacles patients must be prepared to address.

From the restaurateur's perspective, high staff turnover and part-time staff make training or standardization of food allergy policies difficult to implement. When dining in a restaurant, patients should address food allergy queries to the restaurant manager. The manager is often more seasoned and less distracted than harried wait staff, increasing the chances that the patient will receive accurate information [36].

Furlong *et al.* reported that reactions in restaurants were caused by a number of factors: the food-allergic individual not telling the wait staff about the food allergy; cross-contact between foods (primarily from shared ice cream equipment, from cooking surfaces, and serving utensils); and establishment error (e.g. switching ingredients and not notifying the wait staff). Half of the reactions were caused by allergens in unexpected places, for example, in sauces, dressings, or in egg rolls. Desserts accounted for 43% of the reactions, followed by entrées (35%), appetizers (13%), and others (9%) [16].

There are some simple strategies for avoiding a reaction in a restaurant setting. Individuals who are allergic to peanuts or tree nuts should not eat in Chinese, Thai, Indian, or other Asian-type restaurants. These ingredients are commonly used in many dishes and cross-contact between foods during meal preparation and cooking is likely. Peanut-allergic individuals have reported reactions after eating Mexican food. These restaurants are now using peanut butter in some dishes, an example is enchilada sauce.

Patients who are allergic to fish or shellfish should avoid eating at seafood restaurants. The oil, grill, and other cooking areas are likely to contain small amounts of fish or shellfish protein that could come into contact with the fish-free meal. Some individuals are so sensitive to a food that

simply breathing the aerosolized protein in steam can cause a severe or even fatal reaction. A shrimp-sensitive woman is said to have suffered fatal anaphylaxis within minutes after a waiter in a restaurant walked past her carrying a sizzling shrimp dish [8].

Buffet-style service offers another potentially high risk for cross-contact. The food is often placed in serving dishes that are close to each other, and small amounts of one food may fall into another serving dish; diners often dip one spoon into several dishes. Finally, dishes and their ingredients are rarely identified. One woman learned after she had a reaction that the food she ate contained walnuts.

While eating in a fast-serve or fast-food restaurant, it is not prudent to assume that what is safe in one restaurant will necessarily be safe in another. Although food preparation at chain restaurants is usually standardized, regional differences may exist in products served or ingredients used [37]. Franchise owners may not follow corporate policy regarding separation of various foods during cooking and preparation.

When eating in restaurants, individuals with food allergies will minimize the chance for an allergic reaction if they identify themselves to the wait staff and manager, ask questions about ingredients used, cooking methods, that is whether the grill is greased with butter, the use of "secret ingredients," and ask for advice on selecting menu items. Patients should order simply prepared foods with as few ingredients as possible, for example, a baked potato without the toppings.

A peanut-sensitive teenager died after eating an egg roll at an oriental restaurant [38]. He apparently had asked the waiter if any of the food was cooked in peanut oil, and was assured that the restaurant did not use any peanut oil. He may not have inquired about the use of peanut butter, which the restaurant used in its egg rolls. As a rule, if the patient has any doubt about whether his or her questions and concerns are being taken seriously, the individual should eat elsewhere.

To discreetly and consistently convey information to the restaurant staff, some teens and young adults prefer to use a "chef card" (Fig. 36.2). These personalized cards usually include the list of synonyms for the allergen, a caution about food preparation, and the symptoms of a reaction (to convey the seriousness of the food allergy). Some use a brightly colored laminated card; others have business cards printed with this information.

When it comes to menu selection, avoidance of high-risk foods on a menu, such as sauces and desserts, foods prepared in a pastry covering, combination foods (such as stews), and fried foods, may help patients avoid an allergic reaction.

Surprise use of allergens include almonds in dressings for chicken entrees, sauces used on fresh fruit and in baked goods. Eggs used to create foam for milk toppings on

Sample Chef Card

To the Chef:

WARNING! I am allergic to peanuts. In order to avoid a life-threatening reaction, I must avoid the following ingredients:

Artificial nuts

Beer nuts

Cold pressed, expelled, or extruded peanut oil

Ground nuts

Mandelonas

Mixed nuts

Monkey nuts

Nut pieces

Peanut

Peanut butter

Peanut flour

Please ensure any utensils and equipment used to prepare my meal, as well as prep surfaces, are thoroughly cleaned prior to use. Thanks for your cooperation.

Figure 36.2 Sample chef card.

specialty coffee drinks, as a binder in meatballs or meatloaf and as a glaze on baked goods. Peanut butter used to thicken chili, Mexican salsa, spaghetti sauce, hot chocolate, and brown gravy [15]. It also has been used as the “glue” to hold egg rolls and Rice Krispie treats together, to add crunch and texture to piecrusts and cheesecakes, and to add flavor to brownies.

Nuts and other toppings are often accidentally dropped into containers of ice cream. Furthermore, the scoopers for the various flavors are often placed in a common tub of water, which may contain protein from all of the different flavors.

It is a common industry policy for restaurants to cook several types of foods in the same deep-fat fryer. This can pose a risk to the allergic individual who has no way of knowing what other foods were fried in that cooking oil. In one case, an individual with a fish allergy reacted to French fries that had been cooked in the same oil as the fish.

In spite of their precautions, however, mistakes can occur in the kitchen during meal preparation, as well. Several reactions have occurred after the kitchen staff simply removed the allergen rather than making a new dish. To avoid this risk, if a food-allergic individual is served an allergen-containing dish at a restaurant (a cheeseburger instead of a plain burger), the individual should keep the original dish at their table to ensure that a new dish is prepared.

Dining away from home

Selection of low-risk restaurants is key for minimizing the chances of an allergic reaction

Avoiding desserts, sauces, fried foods, and foods in covered pastry will help minimize the chance of an accidental ingestion of an allergen

Teens can use a “chef card” to identify themselves to the wait staff in restaurants

If an order is incorrect, the allergic individual should keep it until a new dish is served

Buffets offer a tremendous risk for cross-contact with allergens and are best avoided

Special occasions

Preparation, planning ahead, and minimizing risks are the key ingredients for success during special occasions such as birthday parties, family gatherings, vacations, and air travel.

Before attending a birthday party or visiting a relative’s house, the hostess should be alerted of the food allergy. Some families prefer to bring their own “safe” food for their peace of mind. For vacations, many rent condominiums or cottages with kitchens so they can prepare the child’s meals themselves. Those that choose this option often bring food with them or ship staples such as bread and cereals to their vacation destination. For sleep away camps the options may include providing the child’s food or reviewing the menu to determine what foods the child can eat. Careful attention should be given to camp activities that will require the children to be in remote areas to be sure emergency-medical services are available if needed.

Regarding air travel, the best policy is to avoid eating any food served by the airline, as ingredient lists are not usually available and the meals are prepared in large warehouses with many opportunities for mistakes or cross-contact to occur. Some families of children with peanut allergy request peanut-free flights. No airline can guarantee a peanut-free flight. There may be peanut ingredients in meals; other passengers may carry peanuts on the plane with them. Some airlines will serve a non-peanut snack upon request; others make no such accommodations. Families would do well to check with the airline when booking their flights, confirm the arrangements before the trip, and keep in mind that airlines change their policy without warning. As a precaution, all families should keep their child’s medications stored in a carry-on bag, and be prepared to treat a reaction should one occur.

According to the Transportation Security Administration (TSA), passengers are permitted to bring self-injectable epinephrine on board, provided that the medication features a professionally printed label identifying the medication or the manufacturer’s name. FAAN recommends that patients carry additional documentation such as a doctor’s

note and the prescription label from the pharmacy. A sample doctor’s note is available on the FAAN web site.

When traveling outside the United States, other problems may arise. In some parts of Europe, for example, product labels do not have to list all ingredients and emergency services differ from country to country. FAAN’s booklet *Travel Guide: Tips for Traveling with Food Allergy* includes information and advice for managing meals while traveling [39].

Treatment of a food-allergic reaction

Since ingestion of food allergens can occur even with stringent avoidance measures, a treatment protocol must be prescribed that is immediately available in case of inadvertent ingestion of the offending allergen. The booklet *“Just One Little Bite Can Hurt”* and *“It Only Takes One Bite”* video (FAAN) are references that can be recommended to patients to raise their own awareness, and that of their families, friends, and teachers, to the potential severity of food allergy [20].

Treatment of a mild reaction

Recently an NIAID-FAAN multi-specialty working group published criteria for diagnosing anaphylaxis (Table 36.3) [40]. In addition, a grading system for the severity of anaphylaxis

Table 36.3 Diagnostic criteria for anaphylaxis

Anaphylaxis is highly likely when any one of the following three criteria is fulfilled:

- 1 Acute onset of an illness (minutes to several hours) with involvement of the skin, mucosal tissue, or both (e.g. generalized hives, pruritus, or flushing, swollen lips–tongue–uvula)
And at least one of the following:
 - (a) Respiratory compromise (e.g. dyspnea, wheeze-bronchospasm, stridor, reduced peak expiratory flow, hypoxemia)
 - (b) Reduced blood pressure or associated symptoms of end-organ dysfunction (e.g. hypotonia (collapse), syncope, incontinence)
- 2 Two or more of the following that occur rapidly after exposure to a likely allergen for that patient (minutes to several hours):
 - (a) Involvement of the skin-mucosal tissue (e.g. generalized hives, itch-flush, swollen lips-tongue-uvula)
 - (b) Respiratory compromise (e.g. dyspnea, wheeze-bronchospasm, stridor, reduced peak expiratory flow, hypoxemia)
 - (c) Reduced blood pressure or associated symptoms of end-organ dysfunction (e.g. hypotonia (collapse), syncope, incontinence)
 - (d) Persistent gastrointestinal symptoms (e.g. crampy abdominal pain, vomiting)
- 3 Reduced blood pressure after exposure to known allergen for that patient (minutes to several hours):
 - (a) Infants and children: low systolic blood pressure (age specific) or greater than 30% decrease in systolic blood pressure*
 - (b) Adults: systolic blood pressure less than 90 mmHg or greater than 30% decrease from that patient’s baseline

(Reproduced from Sampson HA et al. [40], with permission from Elsevier.)
*Low systolic blood pressure for children: 1 month to 1 year < 70 mmHg; 1–10 years < (70 mmHg + (2 × age)); 11–17 years < 90 mmHg

has also been recommended (Table 36.4). The working group sought to distinguish allergic reactions from anaphylactic reactions. A mild allergic reaction is considered to be urticaria/angioedema only with no other systemic symptoms appearing in a patient who is not at high risk for serious anaphylaxis, that is, has never had a previous severe reaction and/or does not have asthma. Alternatively, it might consist of mouth itching only, in a subject who has the oral allergy syndrome [41] and no risk factors. Risk factors for serious reactions to foods include asthma [42], peanut or nut allergy [4,43,44], previous history of severe reaction to any food [4], extreme atopy (with elevated IgE and multiple positive skin tests, atopic dermatitis, food allergy, and asthma) [4,45,46], and use of β-blocking medications [45] (Table 36.5).

For an individual who presents with a mild reaction to a food and has none of the risk factors listed above, treatment may be limited to an antihistamine, preferably liquid diphenhydramine or cetirizine. It should be clearly understood that antihistamines possess no anti-anaphylactic activity and are never a substitute for epinephrine. Whether such a subject who has experienced a mild allergic reaction to a food should routinely carry epinephrine remains the subject of some debate [4,45–47]. However, all patients with IgE-mediated food allergy should be warned about the possibility

Table 36.4 Grading severity of anaphylaxis

Grade	Defined by
1 Mild (skin and subcutaneous tissues, gastrointestinal, and/or mild respiratory)	Flushing, urticaria, periorbital erythema, or angioedema; mild dyspnea, wheezing, and upper respiratory symptoms; mild abdominal pain and/or emesis
2 Moderate (mild symptoms + features suggesting moderate respiratory, cardiovascular, or gastrointestinal symptoms)	Marked dysphagia, hoarseness, and/or stridor; shortness of breath, wheezing and retractions; crampy abdominal pain, recurrent vomiting, and/or diarrhea; and/or mild dizziness
3 Severe (hypoxia, hypotension, or neurological compromise)	Cyanosis or SpO ₂ ≤ 92% at any stage, hypotension, confusion, collapse, loss of consciousness; or incontinence

Table 36.5 Risk factors for a severe allergic reaction to food

Asthma
Extreme atopy
History of anaphylactic reaction to any food
β-blocker treatment
Peanut or tree nut as the allergen
Adolescent or young adult
Lack of readily available epinephrine

of developing a more severe anaphylactic reaction. In addition, parents of young children with food allergy should be advised to contact their physician if their child develops wheezing from any cause, for example viral infection, because evidence of airway hyperreactivity moves the child into a higher-risk group. In some cases, parents of children with mild reactions may prefer to keep epinephrine available for use, but reserve actual administration to occasions on which more severe symptoms develop. All individuals should be instructed in the signs and symptoms of anaphylaxis (Table 36.6) and warned to use epinephrine immediately and seek emergency care if significant symptoms develop (see Chapter 13). A written Food Allergy Action Plan clearly describing what symptoms to look for and what to do if a reaction occurs should be provided to these patients and their caregivers.

Treatment of moderate to severe reactions

Any individual who has a history of an IgE-mediated reaction to a food, especially if it was more severe than urticaria only, mouth itching only, mild tightness in the throat, and/or who has any of the risk factors listed above should be considered at risk for a more serious subsequent reaction. Some of the most severe reactions may not, in fact, have urticaria associated with the symptom complex [4,45,46,48–52]. The treatment of choice in such cases is epinephrine administered by intramuscular injection [52,53]. The point at which to administer epinephrine remains controversial. Traditionally, administration was delayed until the onset of serious symptoms, but evidence suggests that it may be a poor policy to wait for severe symptoms to develop in high-risk subjects [4,7,50]. *In any patient with a history of a severe reaction, epinephrine should be administered as soon as it is realized that the allergenic food has been ingested.*

Table 36.6 Clinical features of anaphylaxis

Cutaneous	Urticaria, angioedema, pruritus, flushing, morbilliform rash
Respiratory	Upper airway – rhinorrhea, congestion, sneezing, stridor, hoarseness, “lump in throat” lower airway – cough, wheeze, dyspnea, chest tightness, cyanosis
Cardiovascular	Tachycardia, arrhythmia, syncope, hypotension, shock
Gastrointestinal	Pruritus or edema of the lips/tongue/palate, metallic taste in the mouth, nausea, vomiting, abdominal cramps, diarrhea
Genitourinary	Uterine cramping, uterine bleeding
Neurological	Anxiety, headache, seizure, syncope, loss of consciousness
Ocular	Pruritus, conjunctival injection, lacrimation

*Patients presenting with any of the symptoms depicted in bold should be given epinephrine immediately.

Epinephrine is currently available in pre-measured doses for patient use from only one source. The EpiPen® (Dey; Napa, CA) and Twinject® (Verus Pharmaceuticals; San Diego, CA) are single and double unit-dose devices, respectively, for use in adults and children weighing 28 kg or more [54,55]. They deliver 0.3 mg of epinephrine as 0.3 ml of 1:1000 solution in an automatic syringe preloaded for intramuscular injection. The EpiPen® Jr. (Dey, Napa, CA) and Twinject® Jr. (Verus Pharmaceuticals; San Diego, CA) are intended for smaller children; it delivers 0.15 mg of epinephrine in 0.3 ml of 1:2000 dilution of epinephrine. In children weighing less than 10–15 kg, one may either administer the EpiPen® Jr. For children less than 10 kg, a needle, syringe, and vials of epinephrine may be prescribed, but the reliability of dosing administered by parents is highly variable [56]. The usual dose of epinephrine is 0.01 mg/kg body weight up to a maximum of 0.3 ml, but larger doses may be well tolerated. Epinephrine kits ideally should be stored between 59°F and 86°F.

Inhaled epinephrine delivered by metered-dose devices has been compared with injected epinephrine [57,58]. Theoretically, this treatment could allow more rapid deposition of epinephrine at the site of laryngeal edema. Doses of 10–20 puffs of metered-dose inhaler-delivered epinephrine comparable to those provided with the injection of 0.3 ml of 1:1000 epinephrine, although the duration of effect may be somewhat shorter. While anecdotal reports of successful use of this treatment are known [46], but a study by Simons has shown that children are not able to inhale adequate amounts of epinephrine by this method [59].

A rapidly absorbed antihistamine (H1 antagonist) should be prescribed for all patients with IgE-mediated food allergy. Liquid diphenhydramine, 1 mg/kg up to 75 mg, or cetirizine, 0.25 mg up to 10 mg, are rapidly absorbed and may ameliorate some symptoms of anaphylaxis. However, antihistamines should never be considered as a substitute for epinephrine in the treatment of anaphylaxis.

Corticosteroids provide no immediate effect, but are usually recommended for use early in the treatment of moderate to severe anaphylaxis, in the hope that they will prevent or ameliorate a prolonged or biphasic reaction [50,60]. Furthermore, they restore the responsiveness of β -receptors to their agonists. Patients who have severe anaphylaxis or who have received corticosteroid therapy during the previous 6 months should receive pharmacological doses of corticosteroids [50].

Individuals who have food allergy and asthma appear to be at higher risk for severe allergic reactions than those without asthma and food allergy [4,52]. Bronchodilators may be used during a reaction. However, these or other asthma medications should never be used as a substitute for epinephrine.

Treatment of extremely severe reactions

Life-threatening anaphylaxis from food ingestion typically involves severe compromise of the upper and lower respiratory

Table 36.7 Management of anaphylaxis

Assessment
Check airway; secure if necessary
Assess level of consciousness
Obtain vital signs
Estimate body weight
Initial therapy
Epinephrine
Further treatment based on evaluation of clinical condition
General
H1 antihistamine
Corticosteroids
Oxygen
Elevate legs and lie flat if tolerated
Respiratory symptoms
Nebulized β -agonist
Aminophylline
Nebulized epinephrine
Cardiovascular symptoms
Intravenous fluids (colloid or crystalloid)
H2 antihistamine
Inotropic agent
Vasopressors
Glucagon
Assisted ventilation

tract, although cardiovascular reactions, including dysrhythmias and shock can develop [61,62] (see Chapter 13 for further discussion). The treatment approach should be tailored to the condition of the patient (Table 36.7). If any question arises about the adequacy of cardiopulmonary function, the caregiver should administer supplemental oxygen, secure an intravenous line, and begin cardiac monitoring.

In the hypotensive patient, the combination of H1 and H2 antihistamines in addition to intravenous fluids may represent an additional treatment strategy. Studies suggest that this combination could protect against the decrease in diastolic blood pressure linked to histamine [63,64]. For example, 1-mg/kg diphenhydramine and 4-mg/kg cimetidine could be infused slowly [65]. The effectiveness of this therapy as a prophylactic agent in preventing histamine-induced hypotension is generally accepted [66]; however, its use in the treatment of acute anaphylaxis remains more controversial [67,68].

Respiratory symptoms

Food allergy may provoke severe asthmatic attacks, which result in death or require mechanical ventilation [42,45]. In addition to intramuscular epinephrine, the treatment approach to severe bronchospasm resembles that for any asthma attack, with the understanding that recurrent or prolonged severe obstruction may occur, necessitating the need for observation to continue for at least 4 hours after a satisfactory response to treatment [4,52]. A β -agonist such

as albuterol, nebulized with oxygen, provides the basis of treatment. If upper airway edema appears, nebulized racemic epinephrine may be administered. In the face of severe bronchospasm, intravenous aminophylline may be used, although albuterol, aminophylline, and hypoxia carry some risk of additive cardiac toxicity [69]. Intubation and assisted ventilation may be necessary [50,61,70]. Edema of the upper airway, a less common effect, may also occur [50,71]. Intubation or cricothyroidotomy may be necessary.

Advice to patients for treating a reaction

All patients with food allergy should be instructed in avoidance of the incriminated food. However, in spite of best efforts to avoid the food allergen, reactions are likely to occur from “hidden” ingredients. Vander Leek reported that 60% of 83 peanut-allergic children had a total of 115 documented adverse reactions caused by accidental exposure to peanuts during follow up [3,30].

Patients need to be taught the early warning symptoms of a reaction to a food. Even if they have previously had only mild reactions, they should be educated about all possible symptoms that may develop in more severe allergic reactions. Each food-allergic subject must maintain constant scrutiny of his/her diet. All food-allergic individuals should receive information concerning emergency medical identification systems such as MedicAlert® (www.medicalert.org).

Some debate has arisen about which patients should receive a prescription for epinephrine, although all agree that subjects at risk for a severe food-allergic reaction should carry epinephrine [4,50]. The medical record should include documentation of patient instruction in the identification and treatment of an allergic reaction. The patient needs to be given written instructions for when and how to use the prescribed epinephrine auto-injector, urged to carry epinephrine at all times, and to use it early in the course of a reaction, as lack of epinephrine administration can prove catastrophic [4,5,72]. *Up to a third of food-allergic patients experiencing moderate to severe reactions may develop biphasic reactions.* Therefore, all patients must seek professional medical care after using epinephrine, even if symptoms appear to have resolved [50,70]. They must remain under observation for 4–6 hours, as a precaution. Patients should be warned that, while an H1 antihistamine may ease symptoms of itching and urticaria, this medication is not a substitute for epinephrine. Likewise, asthma medications should not be used in place of epinephrine.

In the United States, many states do not allow Emergency Medical Technical (EMT), Basic EMTs, who represent 72% of all emergency medical service personnel, to carry and administer epinephrine. The EMT Basics are usually the first to arrive in response to a 911 call. Patients should be advised to call their rescue squad ahead of time, warn them of their need for epinephrine in case of a medical emergency, and set up an acceptable safety net. In some cases,

if they tell the 911-dispatcher that they need epinephrine, an Advanced Life Support (ALS) vehicle and paramedics will be sent. All ALS vehicles in the United States are staffed by paramedics who can carry and administer epinephrine.

Prevention of food allergy

In addition to allergen avoidance, prevention of food allergy may include preventing sensitization to allergens by means of early allergen avoidance, as discussed further in Chapter 38, administering drugs to allow ingestion of the food culprit, and altering established food sensitivity through immunological modification.

Prevention of sensitization

Since 1936, when Grulee and Sanford reported that infants who were breast-fed developed less eczema than those who received cow's milk, the idea of manipulating the infant's diet to decrease the development of allergic disease has drawn great attention [73]. This topic has been extensively reviewed [74–76]. The picture that emerges does not present a strong argument for the success of this approach [76].

Studies performed primarily in Sweden have shown that neither avoidance nor ingestion of large amounts of cow's milk or egg during the third trimester of pregnancy affect the development of atopic disease from birth to 5 years of age [77–79]. Many studies have found that dietary intervention after delivery may result in a lower incidence of food allergy and atopic dermatitis by age 12–24 months [77,80–85]. Such dietary intervention has included modalities such as strict breast-feeding combined with avoidance of highly allergenic foods by the lactating mother, or the use of protein hydrolysate formula instead of breast-feeding and diet regulation. Zeiger *et al.* published an outcome study on 165 children aged 7 years who were at high risk to develop atopic disease [86]. These children had been followed since birth in a prospective randomized-controlled study of food allergen avoidance. In the prophylaxis group, the mother had avoided cow's milk, egg, and peanut in the last trimester of pregnancy and throughout lactation, and the infant had avoided cow's milk until age 1, eggs until age 2, and fish until age 3 years. The control infants followed standard infant feeding practices. Although a significant reduction in food allergy and atopic dermatitis was noted in the prophylaxis group by age 1 year, this effect had faded by age 2 years and disappeared by age 4 years [80,87]. By age 7 years, no difference was found in the development of food allergy or any other atopic disease in either group [86]. Even in carefully designed studies, it appears that dietary manipulation might lessen the frequency of food allergy during infancy – a time when it may be quite troublesome – but it does not seem to affect the eventual outcome of food allergy, and has not resulted in any decrease in the frequency of respiratory allergic diseases [84,86,88]. Prophylactic feeding with soy

formula has not been found to be effective in preventing the development of food allergy [89].

The American Academy of Pediatrics policy statement titled, “Hypoallergenic Infant Formulas” recommends, “Infants at high risk for developing allergy, identified by a strong (biparental, parent, and sibling) family history of allergy may benefit from exclusive breast-feeding or hypoallergenic formula or possibly a partial hydrolysate formula.” For these infants, solid foods should not be introduced until 6 months of age. Dairy products should not be introduced until age 1; eggs at age 2; and peanuts, tree nuts, and fish at age 3 years [90]. However, new guidelines will be released soon that are similar to what has been recommended in Europe [84], which do not promote allergen exclusion diets.

Drug treatment

Although the major emphasis in preventing food allergy involves avoidance with instructions for treatment if accidental ingestion occurs, it is not always possible to avoid a food entity completely. It would be desirable to have a drug that could be taken either before deliberate ingestion of a food or on a regular basis to decrease reaction to an accidentally or episodically ingested food, but no such drug is available at the present time. As discussed further in Chapter 42, Traditional Chinese Herbal Medicines may provide a means of treating patients prophylactically in certain “high-risk” situations.

Allergen immunotherapy

Allergen immunotherapy remains a time-honored treatment for allergy. In view of the severe and persistent nature of peanut allergy, it was hoped that a trial of immunotherapy could alter the natural course of this condition. Oppenheimer *et al.* reported the results of a double-blind, placebo-controlled study in three subjects with anaphylactic sensitivity to peanuts that underwent rush desensitization with peanut allergen [91]. A follow-up study of this group 1 month after rush immunotherapy revealed a 10- to 100-fold reduction in prick skin test sensitivity and a 2- to 20-fold increase in antigen dose on double-blind, placebo-controlled challenge [92]. Both rush and maintenance immunotherapies were associated with a significant frequency of generalized reactions; 23% during the build-up phase and 37% during maintenance. It was concluded that traditional immunotherapy was not feasible for the treatment of food allergy. Recently there has been renewed interest in oral immunotherapy [93–95] and sublingual immunotherapy [96], and although promising, more placebo-controlled trials are necessary to determine the efficacy of these forms of therapy. In addition, a number of novel immunotherapeutic strategies, including anti-IgE therapy [97], use of recombinant “engineered” proteins [98], etc. are being investigated, as discussed in Chapter 42.

Summary

The diagnosis of food allergy impacts the patient, family, and other caregivers. Education regarding label reading, identification of symptoms, and a written emergency action plan should be given to all patients with food allergies. Access to newsletters such as *Food Allergy News* (published by FAAN; Fairfax, VA), warning jewelry (MediAlert, Turlock, CA), and careful planning are all essential in managing food allergy and allowing the patient to receive the education and emotional support necessary for managing food allergies. At present, efforts to prevent sensitization to foods or to allow the deliberate ingestion of food allergens with drug pre-treatment remain at the experimental stage, as does the use of allergen immunotherapy to desensitize the food-allergic patient.

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